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Smart move? The spatial mobility of higher education

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Smart move?

The spatial mobility of higher education graduates

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RIJKSUNIVERSITEIT GRONINGEN

Smart move?

The spatial mobility of higher education graduates

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Voorwoord

Ik was zelf wel de laatste die een vermoeden had van welke richting dit onderzoek op zou gaan. En hoe kon ik ook anders? Al mijn vrienden bij studievereniging voor Algemene Economie Creative Destruction waren, zoals het hoort (zie hoofdstuk 2), naar het Westen vertrokken. Dat doen afgestudeerden toch uiteindelijk allemaal? We hebben met dit onderzoek bijgedragen aan een andere kijk op het fenomeen afgestudeerdenmigratie, vooral ook bij mijzelf. Ik ben een heel aantal mensen dank verschuldigd, voor het welslagen van dit project uiteraard, maar ook voor de plezierige afgelopen jaren bij de Faculteit Ruimtelijke Wetenschappen, vanaf het moment dat ik er als student Demografie binnenliep.

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Overview of Chapters

Chapter 2 – Do the best graduates leave the peripheral areas in the Netherlands?

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Chapter 3 – An analysis of trends in spatial mobility of Dutch graduates

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Chapter 4 – Entry into working life: spatial mobility and job match quality of higher educated graduates

Chapter based on: Venhorst, V.A. and F. Cörvers (2010) Entry into the working life: spatial mobility and job-match quality of higher educated graduates. NARSC Conference, 10th - 13th November 2010, Denver, CO, USA.

Chapter 5 – Human capital spillovers in Dutch cities: consumption or productivity?

Chapter based on: Venhorst, V.A. (2011) Human capital spillovers in Dutch cities: consumption or productivity? 51st WRSA Conference, February 8 – 11 2012, Kauai, Lihue, Hawaii, United States of America.

1. Introduction

1.1 Human capital and growth

The literature has given much attention to persistent differences in growth rates between nations and regions. Romer (1986, 1990) and Lucas (1988) are credited with suggesting that human capital, a term originally coined by Becker (1964), is a key factor in explaining these differences. Lucas (1988) distinguishes between private benefits and external benefits of human capital. The private benefits can be thought of as the returns to an individual, for example in terms of a higher wage rate, from an investment in education. External benefits are the wider returns to the economy, or society, at large (see also Rauch, 1991).

Building on the work by Romer (1986) and others, Lucas (1988) argues that, provided external benefits of human capital are present, labour will accumulate in those locations with higher general levels of human capital because the productivity of a given worker increases in line with the human capital of nearby workers. As a result, factor prices will not equalize between economies to the extent predicted by neo-classical economic theory, and labour will continue to move towards regions abundant in human capital. Even though his theory is in essence a-spatial, Lucas suggests that these external benefits, or spillovers, drive the growth of cities. Romer (1990) postulates that technological change is fundamental to economic growth. In his framework, technological change, or in other words knowledge creation, is the result of conscious decisions by economic agents driven by market returns. However, a technological improvement, once it has been realized, can be characterized as a non-rival good since it can be replicated at zero cost if it is not protected by a patent. Investing in technological change is therefore likened to a fixed cost, which suggests that it is more likely to occur in large markets. Romer argues that a sizeable stock of

human capital, rather than simply a large population, drives growth as highly skilled workers are instrumental in research and development. As a result, the presence of human capital, or trade with economies that exhibit high levels of human capital, is regarded as critical for economic growth rather than size or trade as such.

These theoretical advances have spurred a large body of literature that has focused on the role of human capital as an engine for economic growth. Firstly, there has been attention given to measuring the extent of human capital externalities (Acemoglu and Angrist, 2006, Duranton and Puga, 2004, Glaeser, 1999, Moretti, 2004a, 2004b, 2004c, Shapiro, 2006). Secondly, at the micro-level of individual agents, research has focused on the location decisions made by high human capital individuals as well as the individual returns on education in relation to spatial mobility (see, for example, Fielding, 1992, Berry and Glaeser, 2005, Détang-Dessendre *et al.*, 2004, Lehmer and Ludsteck, 2011).

In line with this, there has been increasing attention in the literature on the spatial mobility of a specific group of high human capital individuals: young, recent graduates¹. The degree of spatial mobility differs strongly among age groups (Plane, 1993), and young, recent graduates especially exhibit strong propensities to be mobile. It is therefore not surprising that Dutch regional and local policymakers focus on attracting and retaining high human capital individuals when they are most mobile: directly after graduation from an institute of higher education (Venhorst *et al.*, 2011). However, knowledge is lacking as to what drives migration by these young graduates and what the effects of spatial mobility are on the individual and on the region.

In this thesis, we study the spatial mobility of recent graduates from Dutch institutions of higher education. This thesis builds on insights from a number of key studies in this field, which will be discussed in Section 1.2, specifically focussing on the drivers of location decisions by the more highly skilled. In Section 1.3, we present our main research questions and an outline of this thesis.

1.2 Spatial mobility of high human capital individuals: causes and consequences

Nijkamp and Poot (1998) note that highly skilled migrants may add to an economy's rate of capital accumulation. This is especially the case for regions within the same national economy since there are usually no constraints on internal migration and therefore human capital can flow freely into and out of regions. These flows of human capital may have consequences for the growth trajectories of these regions. Faggian

¹ See for example Biagi *et al.* (2011) for Italy, Consoli *et al.* (2011), Haapanen and Tervo (2010) and Jauhainen (2011) for Finland, Corcoran *et al.* (2010) for Australia, Faggian *et al.* (2007) for the United Kingdom and Waldorf (2009) for the United States.

and McCann (2009) note that growth disparities between regions could well be related to imbalances in the human capital characteristics of migrant flows. Some regions may be confronted with structural outflows of individuals with high human capitals. These outflows could self-reinforcing, leading to a stronger outflow of human capital, if the human capital base of a region falls and the aforementioned external effects and spillovers diminish. Berry and Glaeser (2005) note that US cities appear to be diverging in terms of their skills structure: smart cities are becoming smarter. However, for Germany, a convergence in the skills structures of labour market regions has been found, which suggests that complementarities between skills levels also play a role (Suedekum, 2009). Evidence has been found for such human capital spillovers in regions (Rauch, 1991, Moretti, 2004a) and in industrial plants (Moretti, 2004c). As such, the effects of structural in- and out- flows of human capital on regional economies are not yet entirely clear. Moretti (2004b) also points to additional, non-economic benefits from the presence of highly educated individuals since this group tends to engage more in society. McMahon (2009) provides an overview of these broader benefits of higher education.

The literature provides a variety of arguments as to why high human capital individuals might be expected to be more spatially mobile. Here, Faggian and McCann (2009) provide a concise overview. Most importantly, the opportunity costs of staying in an inferior situation are higher for those with high human capital, plus their higher information gathering skills reduce the likelihood of a move resulting in an inferior outcome. A variety of studies has demonstrated that migration is selective: those that are more likely to generate a good outcome as a result, are the more likely to migrate (Krieg, 1997, Lehmer and Ludsteck, 2011, Nakosteen and Westerlund, 2004, Nakosteen *et al.*, 2008, Smits, 2001, Yankow, 2003). Moreover, previous mobility may lower the barriers to subsequent spatial mobility as the psychological costs of moving are lower (DaVanzo, 1983). In the case of high human capital individuals, this is especially important as, more often than not, opportunities for higher education are in central locations. As a result, for this group, a degree of spatial mobility is necessary to gain access to these institutions and, as a result, barriers to subsequent spatial mobility are lowered.

From a regional perspective, it is crucial to understand what factors can serve to attract high human capital individuals. The debate in the literature has focussed on two main attractors: amenities and economic factors (Greenwood and Hunt, 1989, Storper and Scott, 2009, Partridge, 2010, Graves and Linneman, 1979, Gottlieb, 1995). Plane (1993) and Whisler *et al.* (2008) have however demonstrated that migration propensities and the main determinants of migration differ among individuals and in different stages of the life course. It is not unreasonable to expect recent graduates

from higher education establishments to have different priorities to individuals who are in the process of household formation or who are older. Early contributions in this field, such as Sjaastad (1962), have shown that migrants move to regions with higher wage rates, or towards regions that better reward the own skills level (Borjas, 1987, Borjas *et al.*, 1992). Migration has also been approached as a form of spatial job search (Pissarides, 1976, Herzog Jr. *et al.*, 1993) or as a way to escape adverse regional circumstances (Détang-Dessendre, 1999, Van Ham *et al.*, 2001a). From this body of literature, it is clear that migrants do indeed flow towards regions that provide better economic opportunities, and that individuals with high human capitals are the most likely to move. Empirically, it has been demonstrated that such economic considerations are also of great importance to younger school leavers (Gottlieb and Joseph, 2006, Détang-Dessendre *et al.*, 2004). In this light, in our study of the spatial mobility of higher education graduates, we will attempt to map out the role of economic determinants as well as the regional economic consequences of this spatial mobility of recent graduates.

1.3 Research questions and thesis outline

The above discussion in Section 1.2 showed how regions can benefit from the presence and inflow of human capital. Regional stocks of human capital can be augmented through greater participation in the education system, for example by hosting institutions of higher education. However, it has also been demonstrated that human capital is mobile, and as a result can be attracted from, or may “leak” to, other regions or abroad. Even though structural outflows of high human capital may have an impact at the macro-level of regions, it is crucial to understand what drives these migrants at the micro-level if policies are to be properly targeted. This requires an understanding of the composition of the overall flows and their destinations, rather than focussing on the net flows as such.

This results in two sets of research questions. The first set is concerned with drivers of graduate spatial mobility, the second set concerns the returns on migration both for the individual graduate, as well as for the receiving cities or regions.

In Chapter 2, we demonstrate that there have been substantial net flows of recent graduates from universities and colleges in the northern, eastern and southern regions of the Netherlands towards the larger cities in the west. These persistent flows are indicative of what has been referred to as an imbalanced flow, or a “brain drain”, which can potentially result in an erosion of the human capital base of the more peripheral regions. Here, the central question is whether these peripheral regions are able to attract or retain those graduates that are required by the local labour market.

We approach this question by studying the effect of graduation grade and discipline on the likelihood of moving within, between, or beyond peripheral regions for those having graduated within such a region. Here, we apply a spatial interpretation of the Thurow (1975) labour queue model and ask whether peripheral regions are at least able to retain the better graduates in the varying disciplines.

In Chapter 3 it is noted that some regions have, over time, been able to retain a larger share of their college graduates than others. In parallel, university graduates have become increasingly likely to move abroad. In the chapter we assess the key individual and regional economic and non-economic drivers behind these trends in graduate spatial mobility.

In Chapters 4 and 5 we turn to the second set of research questions. The central question is what drives the individual and regional returns on the spatial mobility of recent graduates? In Chapter 4, we focus on the individual returns on migration, studying labour market outcomes such as the commonly used wage rate plus a range of alternative measures related to the quality of the job-match. The main question is whether the job-match quality is driven mainly by individual characteristics, rather than by a move as such.

In Chapter 5, we focus on the effects of an inflow of graduates on a city's labour and residential markets. There is a strong focus among local policymakers on attracting and retaining human capital, but there is little knowledge on how this affects a city's skills structure in the longer term: does the presence and inflow of highly skilled workers and inhabitants create or reduce the opportunities for other skill groups? If so, is it productivity or consumption spillovers that represent the most important mechanism through which these effects take place? In Chapter 5, we take a somewhat broader approach to human capital than is often employed, by operationalising the city's skills structure in terms of the skills required for the job rather than a purely education-based measure, when studying the effects of graduate spatial mobility on a city's wider working population in general.

Faggian and McCann (2009) observe that the concept of human capital has become somewhat diluted. Definitions range from a strict years-of-schooling concept to a broad concept encompassing all the skills and experiences embodied in a healthy body. In this thesis, with its focus on young, recent graduates with a tertiary degree, we operationalise human capital using a level-of-education based approach. It can be argued that, for this particular group, education level is an appropriate proxy for skills since other skills, such as those resulting from work experience, have not yet been accumulated to any large extent. Further, in the labour market, especially in terms of a

first job, the degree acquired in terms of level and academic discipline is a critical signal as to the suitability of the graduate for a specific job.

Throughout this thesis we distinguish between the two tiers that exist within the Dutch tertiary education system, which consists of colleges of higher education and academic, or research, universities. The colleges of higher education (in some countries referred to as polytechnics) provide education programmes on the professional level. The research universities provide academic programmes. A second important difference between these two groups for this research is in their spatial spread, with colleges of higher education spread more evenly across the country. The terms “college” and “university” are applied throughout this thesis to distinguish between them. Unlike in many other countries, the quality levels are not perceived as varying that much between different colleges and between the various universities. This implies that, in general in the Dutch context, the choice of study location is determined to an important extent by the programmes available at the various colleges and universities, rather than by perceived or actual quality differences.

In Chapters 2 and 3, spatial mobility is operationalised as a move from the study location to a work location, in line with the theoretical implications of the external effects of regional human capital. In Chapter 4, we add the distance between a graduate’s home region (i.e. residence at age 16) and their college or university, and in Chapter 5 we also include residential mobility – i.e. the move from college or university to a new residential location.

This study considers the feedback between the micro- and macro- levels in regional economies: which economic factors are important in attracting graduates? What are the consequences of spatial mobility for recent graduates? What consequences does the migration of recent graduates have for cities? Answers to these questions contribute to the debate on the role of human capital in regional economic development.

References

- Acemoglu, D. and Angrist, J. (2000) *How large are human capital externalities? Evidence from compulsory schooling laws*. NBER Macroeconomics Annual, 15, 9-59.
- Becker, G. (1964) *Human capital*. New York: Columbia University Press.
- Berry, C. R. and Glaeser, E. L. (2005). The divergence of human capital levels across cities. *Papers in Regional Science*, 83(3), 407-444.
- Biagi, B., Faggian, A. and McCann, P. (2011). Long and short distance migration in Italy: The role of economic, social and environmental characteristics. *Spatial Economic Analysis*, 6(1), 111-131.

- Borjas, G. J. (1987) Self-selection and the earnings of immigrants. *The American Economic Review*, 77(4), 531-553.
- Borjas, G. J., Bronars, S. G. and Trejo, S. J. (1992) Self-selection and internal migration in the United States. *Journal of Urban Economics*, 32(2), 159-185.
- Consoli, D., Vona, F. and Saarivirta, T. (2011) Analysis of the graduate labour market in Finland: spatial agglomeration and skill-job match. *Regional Studies*, DOI 10.1080/00343404.2011.603721
- Corcoran, J., Faggian, A. and McCann, P. (2010) Human capital in remote and rural australia: The role of graduate migration. *Growth and Change*, 41(2), 192-220.
- DaVanzo, J. (1983) Repeat migration in the United States: Who moves back and who moves on? *The Review of Economics and Statistics*, 65(4), 552-559.
- Détang-Dessendre, C. (1999) Reciprocal link between exit from unemployment and geographical mobility. *Environment and Planning A*, 31, 1417-1431.
- Détang-Dessendre, C., Drapier, C. and Jayet, H. (2004) The impact of migration on wages: empirical evidence from French youth. *Journal of Regional Science*, 44(4), 661-691.
- Duranton, G. and Puga, D. (2004) Microfoundations of urban agglomeration economies. In J. V. Henderson and J. F. Thisse (Eds.), *Handbook of urban and regional economics*, Elsevier B.V.
- Faggian, A. and McCann, P. (2009) Human capital and regional development. In R. Capello and P. Nijkamp (Eds.), *Handbook of regional growth and development theories* (pp. 133-151). Cheltenham, UK: Edward Elgar.
- Faggian, A., McCann, P. and Sheppard, S. (2007) Some evidence that women are more mobile than men: Gender differences in UK graduate migration behavior. *Journal of Regional Science*, 47(3), 517-539.
- Fielding, A. J. (1992) Migration and social mobility: south east England as an escalator region. *Regional Studies*, 26(1), 1-15.
- Glaeser, E. L. (1999) Learning in cities. *Journal of Urban Economics*, 46(2), 254-277.
- Glaeser, E. L. and Gottlieb, P. D. (2006) Urban resurgence and the consumer city. *Urban Studies*, 8, 1275-1299.
- Gottlieb, P. D. (1995) Residential amenities, firm location and economic development. *Urban Studies*, 32(9), 1413-1436.
- Gottlieb, P. D. and Joseph, G. (2006) College to work migration of technology graduates and holders of doctorates within the United States. *Journal of Regional Science*, 46(4), 627-659.
- Graves, P. E. and Linneman, P. (1979) Household migration: theoretical and empirical results. *Journal of Urban Economics*, 6(3), 383-404.
- Greenwood, M. J. and Hunt, G. L. (1989) Jobs versus amenities in the analysis of metropolitan migration. *Journal of Urban Economics*, 25, 1-16.
- Haapanen, M., and Tervo, H. (2010) Migration of highly educated: evidence from residence spells of Finnish graduates. *Journal of Regional Science*, Forthcoming
- Herzog Jr., H. W., Schlottmann, A. M. and Boehm, T. P. (1993) Migration as spatial Job-search: A survey of empirical findings. *Regional Studies*, 27(4), 327-340.
- Jauhiainen, S. (2011) Overeducation in the Finnish regional labour markets. *Papers in Regional Science*, 90(3), 573-588.
- Krieg, R. G. (1997) Occupational change, employer change, internal migration, and earnings. *Regional Science and Urban Economics*, 27(1), 1-15.
- Lehmer, F. and Ludsteck, J. (2011) The returns to job mobility and inter-regional migration: Evidence from Germany. *Papers in Regional Science*, 90(3), 549-571.

- Lucas, R. E. (1988) On the mechanics of economic development. *Journal of Monetary Economics*, 22, 3-42.
- McMahon, W.W. (2009) *Higher Learning, Greater Good. The private and social benefits of higher education*. Johns Hopkins University Press, Baltimore, MD, U.S.A.
- Moretti, E. (2004a) Estimating the social return to higher education: evidence from longitudinal and repeated cross-sectional data. *Journal of Econometrics*, 121, 175-212.
- Moretti, E. (2004b) Human capital externalities in cities. In J. V. Henderson and J. F. Thisse (Eds.), *Handbook of urban and regional economics*, Elsevier B.V.
- Moretti, E. (2004c) Workers' education, spillovers, and productivity: evidence from plant-level production functions. *The American Economic Review*, 94(3), 656-690.
- Nakosteen, R. A. and Westerlund, O. (2004) The effects of regional migration on gross income of labour in Sweden. *Papers in Regional Science*, 83(3), 581-595.
- Nakosteen, R. A., Westerlund, O. and Zimmer, M. A. (2008) Migration and self-selection: measured earnings and latent characteristics. *Journal of Regional Science*, 48(4), 769-788.
- Nijkamp, P. and Poot, J. (1998) Spatial perspectives on new theories of economic growth. *Annals of Regional Science*, 32, 7-37.
- Partridge, M. (2010) The duelling models: NEG vs amenity migration in explaining US engines of growth. *Papers in Regional Science*, 89(3), 513-536.
- Pissarides, C. A. (1976) Job search and participation. *Economica*, 43(169), 33-49.
- Plane, D. (1993) Demographic influences on migration. *Regional Studies*, 27(4), 375-383.
- Rauch, J. E. (1991) *Productivity gains from geographic concentration of human capital: Evidence from the cities*. Cambridge MA: National Bureau of Economic Research.
- Romer, P. M. (1986) Increasing returns and long-run growth. *The Journal of Political Economy*, 94(5), 1002-1037.
- Romer, P. M. (1990) Endogenous technological change. *The Journal of Political Economy*, 98(5, Part 2: The Problem of Development: A Conference of the Institute for the Study of Free Enterprise Systems), S71-S102.
- Shapiro, J. M. (2006) Smart cities: Quality of life, productivity and the growth effects of human capital. *The Review of Economics and Statistics*, 88(2), 324-335.
- Sjaastad, L. A. (1962) The costs and returns of human migration. *The Journal of Political Economy*, 70(5, Part 2: Investment in Human Beings.), 80-93.
- Smits, J. (2001) Career migration, self-selection and the earnings of married men and women in the Netherlands, 1981-93. *Urban Studies*, 38(3), 541-562.
- Storper, M. and Scott A. J. (2009) Rethinking human capital, creativity and urban growth. *Journal of Economic Geography*, 9, 147-167.
- Suedekum, J. (2009) Convergence of the skill composition across German regions. *Regional Science and Urban Economics*, 38, 148-159.
- Thurow, L. C. (1975) *Generating inequality*. New York: Basic Books Inc.
- van Ham, M., Mulder, C. H. and Hooimeijer, P. (2001a) Local underemployment and the discouraged worker effect. *Urban Studies*, 38(10), 1733-1751.
- Venhorst, V. A., Edzes, A. J. E., Broersma, L. and Van Dijk, J. (2011) *Brain drain of brain gain? Hoger opgeleiden in grote steden in Nederland*. The Hague, the Netherlands: Nicis Institute.

- Waldorf, B. S. (2009) Is human capital accumulation a self-propelling process? comparing educational attainment levels of movers and stayers. *Annals of Regional Science*, 43(2), 323-344.
- Whisler, R. L., Waldorf, B. S., Mulligan, G. F. and Plane, D. (2008) Quality of life and the migration of the college-educated: A life-course approach. *Growth and Change*, 39(1), 58-94.
- Yankow, J. J. (2003) Migration, job change, and wage growth: A new perspective on the pecuniary return to geographic mobility. *Journal of Regional Science*, 43(3), 483-516.

2. Do the best graduates leave the peripheral areas of the Netherlands?

ABSTRACT² - There is more and more empirical evidence to show that highly skilled people are an important determinant of economic growth. Consequently, policymakers are eager to keep their graduates in the region or attract graduates from elsewhere. It is also well known that people with a higher level of education exhibit high rates of spatial mobility. Much less is known about mobility patterns according to discipline and academic grade. Do the best people stay or leave, and does this vary according to discipline and type of region? In this Chapter, we investigate the relationship between ability, field of study and spatial mobility using a micro-dataset on Dutch university and college graduates. The findings indicate that there are substantial net flows mainly towards the economic centre of the Netherlands, but that there are also flows between peripheral regions and to other countries. We find that university graduates are more spatially mobile than vocational college level graduates and that when one looks at spatial behaviour according to discipline there are also striking differences between graduates. This, however, does not necessarily mean that peripheral regions also lose their best graduates. We find that for several disciplines employers in the peripheral areas are able to retain the graduates with the highest grades, contrary to what the standard human capital framework predicts. However, we find that if graduates leave the region, those with the highest grades are more likely to move abroad.

Keywords: Migration, Higher Educated Graduates, Human Capital, the Netherlands, Periphery, Multinomial Logit

2.1 Introduction

It is widely acknowledged that human capital is a key element in modern economic growth theory. In the Lucas endogenous growth model (1988), sustained economic

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growth is due to the accumulation of human capital over time. In Romer's (1990) analysis, innovations are generated by the human capital stock. Barro and Sala-i-Martin (1995) provide clear empirical evidence that investments in education have a significant positive effect on economic growth. A recent survey of the relationship between human capital and regional development can be found in Faggian and McCann (2009a).

Given the positive relationship between human capital and regional economic growth, it seems logical that increasing the skill level of the population is an important goal of regional policymakers. Investment in education could be one way of achieving this goal, but one of the most robust results in the migration literature is that people who have been through higher education are much more spatially mobile than people with a lower level of education. This implies that regions face the risk of people who have been through higher education leaving the region after graduation. Faggian and McCann (2009b) study the migration aggregate flows of graduates in Great Britain and find that six out of eleven NUTS 1 regions are losing more of their locally educated graduates than are retained. Graduates tend to flow from peripheral regions to London and the South East, but there are also substantial cross-flows between regions.

Berry and Glaeser (2005) show that urban areas with higher levels of human capital have attracted more people who are skilled. This is in line with the empirical evidence provided by Nijkamp and Poot (1998), who find that immigration in general tends to lower growth rates but that the immigration of highly skilled people has a positive effect on growth. This suggests that the migration of highly skilled people is beneficial to urban areas. Does this also imply, however, that this "brain drain" is negative for peripheral regions? This is not necessarily the case. It might be that the number of graduates in the periphery exceeds local demand for people who have been through higher education, because the number of jobs for graduates in the region of study is limited. This situation is more likely to occur if the city or university attracts many students from outside the region, such as the University of Groningen in the north of the Netherlands, where about 40 per cent of the students come from outside this region. If the number of graduates exceeds local demand for graduates, out-migration might be beneficial for the individual graduate but also for the peripheral region, because graduates who were to stay in the region would become unemployed. In this case, there is no negative effect of brain drain, and the out-migration of graduates can be seen as a clean export product. The region benefits from the students during their study period via the expenditure effects of the students and the university employees. In addition, there could be an indirect effect whereby the graduates who leave can be seen as ambassadors of the region if they enjoyed their period of study.

Furthermore, they might even come back to work in the region at a later stage of their career.

In addition to a quantitative mismatch between supply and demand in a peripheral study region, a mismatch can also be of a qualitative nature if the graduates' fields of study do not match local demand. An economist may face a considerably different spatial distribution of job-market opportunities at the regional, national or international level than a medical doctor would. Some further interesting questions are the following: do the best graduates with the highest grades leave or are they hired by the employers in the study region, and do those with the lowest grades leave the study region if there is not a sufficient number of jobs?

In this chapter we will analyse the migration behaviour of graduates who obtained a college or university degree in the Netherlands. We will pay particular attention to the spatial behaviour of graduates who obtained their degrees in peripheral regions, and we will also take into account differences by discipline and grade, and the interaction effect between those two variables. We will review the relevant literature in the next section and we will then outline the data available to us and present a descriptive overview of the migratory flows of the graduates by discipline and grade. In addition, we will discuss the econometric results of a multivariate analysis by means of a multinomial logit model. The final section provides some conclusions and policy implications.

2.2 Literature review

A key notion in migration literature is that migration is strongly selective. Since Gary Becker's (1964) conceptualization of Human Capital, this factor has emerged as central to selection processes in migration. Firstly, high human capital individuals are subject to higher opportunity costs when not working or working in a job in which they earn less than their marginal product. Secondly, this group is more capable of gathering and processing information about options elsewhere. This ability reduces the risks or costs associated with migration, as it reduces the risk of an unsuccessful move. As such, studies often link human capital and migration in terms of the probability of a successful labour-market-related outcome in the destination region, for example, the end of a spell of unemployment (Bartel, 1979). See Herzog *et al.* (1993) for an overview of migration and spatial job search and Hensen *et al.* (2009) for a recent study of the job match of Dutch school leavers. Lippman and McCall (1976, 1979) and Pissarides (1976) developed a search-theoretical framework for job searches.

In terms of interregional migration, a variety of studies have also identified why and how higher levels of human capital generally induce migration in relation to differences in regional economic circumstances, and measured and unmeasured personal characteristics. Detang-Dessendre (1999) studies the relationship between unemployment and migration and notes that migration out of rural areas by young French people is driven by the skill level, whereby the more skilled need to migrate in order to find work whereas the lower skilled do not. In contrast, Kirdar and Saracoglu (2008) find for Turkey that most migrants are unskilled workers who migrate from rural to urban areas. The migration of this unskilled labour to richer regions lowers the growth rates in the rich regions and in this way the migration of unskilled people increases the speed of convergence across Turkish regions.

Van Ham *et al.* (2001) show that what they refer to as “spatial flexibility” leads to better labour market opportunities, but that not all people are equally prone to being spatially mobile. They find that selection occurs along the gender dimension, and migration is only related to opportunities when controlling for these individual level restrictions. With regard to the migration of graduates by gender, Faggian *et al.* (2007a) find that female graduates are more mobile than male graduates in Great Britain, and these results are also found for Italy by Coniglio and Prota (2008).

It becomes clear from these studies that it is in fact the interplay between human capital, regional economic circumstances and personal characteristics that is important in determining spatial mobility. In addition, a number of studies relating to the circulation of human capital look at graduates and systems of higher education. In the literature considerable attention has been devoted to the effect of these institutions on the regional economy, with reference to knowledge spillovers between these institutions and networks of high-tech firms in the vicinity. Faggian and McCann (2008), for example, investigate the significance of these effects, and they conclude that universities and other institutions of higher education serve first and foremost to draw high human capital individuals into regions, which in turn has favourable effects on regional innovation.

Both the potential spillovers as well as the high degree of mobility make university graduates an interesting subject of local policy. Policymakers in more peripheral areas in particular are often faced with negative net migration rates as a result of migration flows to more opportunity-rich regions. The migration of high-potential individuals is more often than not to more opportunity-rich regions, taking the shape of distinct periphery–centre flows of interregional migration. This has been found, for example, for Finland by Ritsilä and Haapanen (2003), for the Italian peripheral region of Basilicata by Coniglio and Prota (2008) and for Great Britain by Faggian and McCann (2009b), and it is in line with what Fielding (1992) refers to as

the escalator effect. According to this paradigm, central regions are able to attract human capital in disproportionate numbers. Within these regions workers then experience a degree of upward mobility that is stronger than elsewhere. Later on in their lives these workers then step off the escalator and cash in on their relative prosperity, for example by acquiring property in a more low-cost but high-amenity region. As such, brain drain is not restricted to the international variety alone.

However, theoretically at least, it stands to reason that what constitutes an “opportunity-rich region” does not automatically imply a given country’s central economic area for all potential migrants. Migration is a costly event, and as early as Sjaastad (1962) it was pointed out that the net benefits for the migrant are important. From the perspective of potential migrants in more peripheral regions, a job opportunity close by could be preferable to a similar opportunity in the central region. Another mechanism is the job-competition model, as put forward by Thurow (1975). In this model, the labour market is not governed by the wage level in regional labour markets responding to shifts in demand and supply, but it is viewed as a market where a given job is matched to the candidate with the best applicable skills. Potential candidates are ranked according to the expected level of costs required to train them for a given job, task or even career. The model then predicts that candidates applying for jobs are queued with the most suitable candidate receiving the job. This result appears to be consistent with Bartel’s argument (1979) and the empirical findings of Faggian *et al.* (2007a) that the most highly skilled workers tend to be less mobile than those immediately below them, because these workers normally have first choice of the opportunities available to them. As such, they can take advantage of the very best jobs that are locally available without having to move, thereby forcing others to move. However, Coniglio and Prota (2008) find empirical evidence that those with the highest marks tend to leave the peripheral Italian region of Basilicata. In applications for the Netherlands, Van Ours and Ridder (1995) find some evidence for job competition among people who have been through higher education in the Netherlands, but they do not relate this to migration. Heijke and Koeslag (1999) argue that both job competition and human capital factors are at play as regards the employability of economics and business graduates.

Human capital-based frameworks often approach the labour market from the supply side. In this chapter, however, we argue that the job-competition model, essentially operating on the demand side of the labour market, can be extended in a number of interesting ways. Firstly, employers are not always capable of directly observing existing skills, and thus predicting training costs, and they therefore might take readily available information, such as the quality of the degree (university versus the more vocational colleges of higher education) or field of study as an indication of

productivity. Secondly, a theoretical implication of the job-competition model is that in regions where the supply of job opportunities is lagging behind, it is actually the group of workers who have lower skills, and hence who are further down the labour queue, that find themselves in a position where they have to be more spatially mobile than their counterparts who have a higher level of education.

Within the highly skilled group of recent graduates, factors that determine the relative position in the labour queue would involve not only the graduation grade as an indication of the level of ability but also the field of study. Once more, what exactly constitutes an opportunity-rich region may be strongly affected by this, as the spatial distribution of employment opportunities is likely to differ between sectors and hence between graduates in different disciplines. Some sectors can be expected to benefit strongly from agglomeration economies or clustering, such as the financial sectors in London and Amsterdam, which may attract economics graduates from all over the world. Other sectors are spread spatially more evenly as a result, for example, of factors related to equitable accessibility (schools, hospitals) or economic organization (retail, consumer services). Therefore, in order to get a good return on the investment in education, the need to migrate to a certain location may differ between fields of study. Some disciplines allow the graduate to be rather flexible in terms of the sectors in which suitable job opportunities can be found (law, economics), whereas others are more restrictive (healthcare, teaching). This may lead to differences between fields of study in the propensity to be spatially mobile. Of the few studies we found that took into account the field of study, Coniglio and Prota (2008) found that graduates in business and engineering have a higher propensity to migrate as jobs in these sectors are underrepresented in peripheral areas. Faggian *et al.* (2007a) found that graduates with arts degrees, which tend to be less specific to employment needs, show lower post-graduation mobility than those with a degree in science or social sciences.

In this chapter, we investigate whether human capital drives graduate mobility in the Netherlands or whether the job-competition model is a more suitable framework.

2.3 Data and empirical setting

The analysis in this Chapter is based on data from the 2003-2008 waves of the HBO- and WO-Monitor, a representative micro dataset on recent Dutch graduates. Graduates are surveyed approximately 18 months after they have completed their studies, and information is collected not only on their discipline of study and other background information but also on their current job. Together with this, spatial information is also collected. In this chapter we define a move as a change between the location of the

studies and the location of the current job, as measured at the level of the four Dutch NUTS 1 regions, or a move abroad.

We selected students aged 20 to 30 at the time of graduation. In this chapter we distinguish between graduates from Dutch vocational colleges, similar to the UK colleges of higher education or German “Fachhochschulen”, on the one hand, and universities, on the other hand. This distinction is necessary as, firstly, colleges are spread more evenly throughout the country than universities, and secondly, they have a stronger focus on the regional labour markets. As such, we expect to find different migration patterns for the graduates involved, with the university graduates displaying a stronger tendency to be spatially mobile. Sample statistics are presented in Appendix 2.A.

Figure 2.1: Migration stocks and flows of graduates, 2003 – 2008, yearly averages.

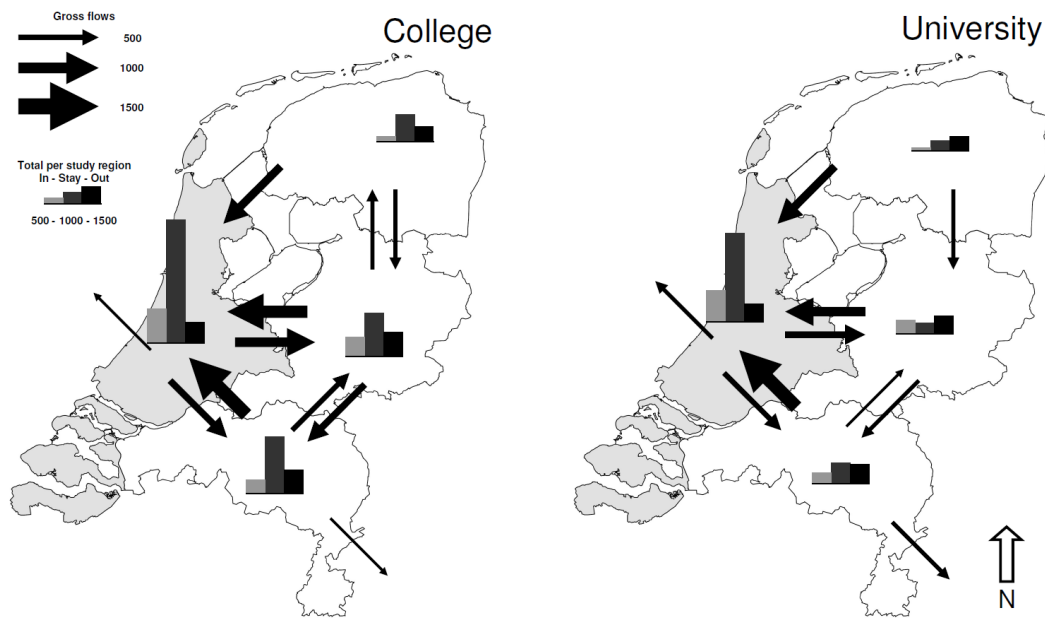


Figure 2.1 provides a first impression of the magnitude and direction of the migration patterns of graduates, measured in yearly averages over the period 2003–2008, separately for college and university graduates. The figure shows both moves within as well as between the central West region and the more peripheral North, East and South regions. For a given study region, the middle bar shows the number of graduates that stay to work in that region. The left-hand bar shows the inflow and the right-hand bar the outflow of graduates who have found a job in another region. The arrows show the magnitude and direction of the migration flows. Flows of less than 100 are not shown.

For university graduates it is clear that the numbers that leave the study region are higher than the number of stayers for the North and East, whereas for the South these numbers are more or less equal. The East and South also show substantial inflow from other regions, whereas inflow to the North is almost negligible. A possible explanation for this is that the only university in the North, the University of Groningen, is a very broad university covering all disciplines, which attracts about 40 per cent of its students from outside the northern region (Van Dijk, 2007). This makes it likely that regional labour demand for university graduates can be easily met by graduates from the university in this region, but that there are not enough jobs in the region to accommodate all graduates. A significant number of the Groningen graduates also move to the East.

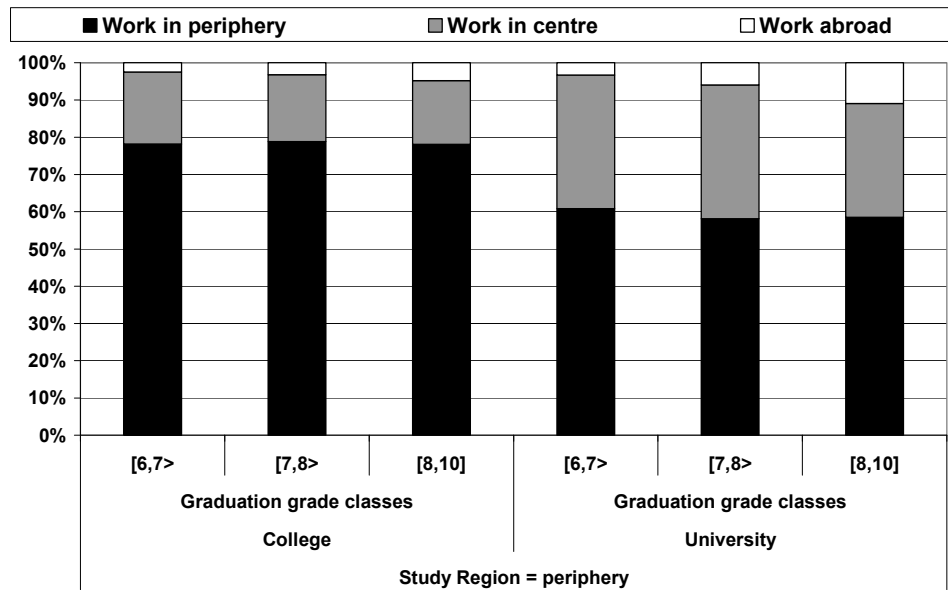
The West gains graduates: the inflow is twice as high as the outflow, which gives rise to a clear pattern of net flows towards the economic centre of the Netherlands from the more peripheral North, East and South. Besides to the West, the graduates from the East and South also migrate between these two regions. From the South a substantial number also goes abroad, but this might be due to the fact that over 30 per cent of the students of the University of Maastricht are of foreign origin (Pellenbarg and Van Steen, 2009). It could be that many students, especially those from Germany and Belgium, move back to their home countries after graduation. We will therefore incorporate a variable indicating the foreign origin of the graduates in the empirical analysis.

The spatial pattern of the migration of college graduates is generally comparable to that of university graduates. However, the intensity of migration is a lot lower. Of the college students who graduated in the peripheral regions, about 21 per cent leave the region of study, which includes the three per cent that go abroad. For university students these figures are almost double: 42 per cent leave the region, of which seven per cent go abroad. This is also reflected in the bar chart: for each region, the number of stayers is substantially higher than outflow or inflow. The lower intensity of spatial mobility for college graduates compared to university graduates may be related to the generally observed pattern where spatial mobility increases with the level of education (a human capital effect). In addition, the colleges are spread much more equally over the country than the universities. In addition, some of the universities, such as the Delft University of Technology, the Eindhoven University of Technology, the University of Twente and the Agricultural University of Wageningen only produce graduates in a limited number of disciplines. For the colleges this specialization is much less marked. Although the number of college graduates that move to another part of the country is lower than the number of university graduates,

in absolute numbers the migration figures are of the same magnitude because the number of college graduates is much higher than the number of university students.

Overall, we may conclude that there is substantial spatial mobility among graduates. In order to gain more insight, our next step was to analyse in more detail the type of students who are moving to the central region. In this respect, we analysed whether there is a distinction in spatial pattern by grade and by discipline. We start this analysis by showing some simple graphs of the bivariate relations and we will then present the results of a multivariate econometric analysis using a multinomial logit model.

Figure 2.2: Choice of work region by grade for graduates who studied in a peripheral region, 2003 – 2008, yearly averages.



We are especially interested in the following question: do the best graduates leave the peripheral regions? Therefore, we present in Figure 2.2 the migration behaviour of students by grade for students who graduated from a college or university located outside the western core region. The three separate peripheral NUTS 1 regions clearly have many specifics, for example with respect to the opportunity to study certain disciplines. We have seen above that there are flows of graduates between these regions, arguably as a result of these specificities. In this study, however, we are particularly interested in what drives the spatial mobility of graduates from the more peripheral areas in general. All regions share a common feature in that they exhibit a brain drain vis-à-vis the West region. Furthermore, they all share borders with either

Belgium or Germany, which for some universities and colleges are important sources of students.

We use information about the graduation grade to measure ability and distinguish between excellent, average and moderate students. The group of excellent students with an average rating³ of 8 or higher consists of about 20 per cent of the total graduate population, whereas the moderate students form a group of about 11 percent of the university graduates and 15 per cent of the college graduates. Figure 2.2 clearly shows that the number of students who leave the peripheral region does not differ when we look at them according to the grade they achieved. However, it confirms that university students are much more mobile than college graduates. In addition, we see an interesting difference within the group of students who leave the region between those who move within the country and those who go abroad. It is clear both for university and college graduates that those with higher grades are much more likely to move abroad, whereas the moderate graduates tend to stay within the country. There is no evidence that the best students leave the periphery, but from the students who leave the best go abroad.

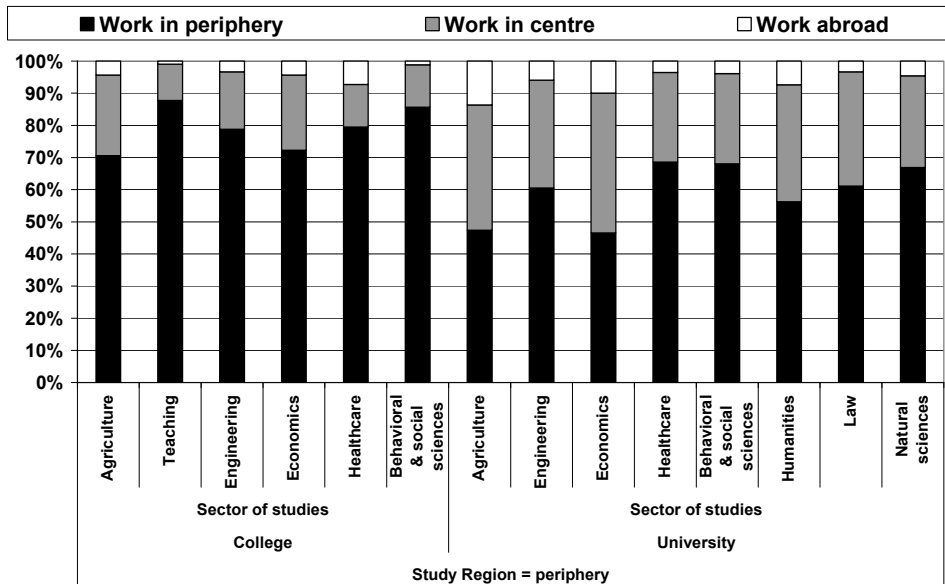
Another important factor that may play a role in the decision to stay in the region of study or to move somewhere else is the degree discipline. For some occupations, the spatial distribution of jobs may be much more equal than for others. In addition, the fact that some disciplines are only available at a limited number of universities or colleges may also have an impact on the migration propensity of the graduates. Figure 2.3 confirms this, as it shows that there are substantial differences by discipline with regard to the region of work for students who graduated in a peripheral region.

Of the university students in economics and agriculture, over 50 per cent move to another region, whereas 70 per cent of the students in healthcare, and behavioural and social sciences (mainly psychologists) stay in the study region. The high mobility rate for agriculture is most likely due to the fact that nearly all of the agriculture students attended Wageningen University, and they need to migrate because the jobs are spread all over the country and often abroad. Wageningen also attracts many students from abroad (about 20 per cent of its students) (Pellenbarg and Van Steen, 2009), and the majority presumably chooses to leave the country after graduation. The pattern by discipline for college graduates is similar to the university graduates, but the

³ The Dutch rating system uses a 10-point scale. The minimum pass grade is 6. Marginal students have a score lower than 7 and excellent (cum laude) students have an average score of 8 or higher.

share that stays in the study region is higher for all disciplines: the most mobile college students are as mobile as the least mobile university students. Of the college graduates, students of agriculture and economics are the most mobile: 70 per cent stay in the region of study. Of the college graduates in teaching, and behavioural and social sciences, more than 85 per cent stay in the study region. Just as with the university graduates, the more equal spatial distribution of jobs in these fields is the most likely explanation for this disciplinary pattern.

Figure 2.3: Choice of work region by discipline for graduates who studied in a peripheral region, 2003 – 2008, yearly averages.



In order to reach reliable conclusions, we carried out a more formal econometric analysis with a multivariate multinomial logit model. This also allowed us to test the hypothesis that there are significant interaction effects between grade and discipline. From our theoretical model, we derive the hypothesis that given the conditions on the regional labour market, the most able graduates within a discipline are more prone to stay if job-competition is the dominant selection force.

2.4 Multivariate analysis

In our econometric analysis, we continue to treat the North, East and South regions as essentially one area, referred to as the periphery. The dependent variable thus consists of three categories that are conceptually sufficiently different to avoid violating the assumption of independence of irrelevant alternatives that underlies the multinomial

logit model. These three categories are ‘Work in the periphery’, ‘Work in centre’ and ‘Work abroad’, with ‘Work in the periphery’ treated as the reference category.

Table 2.1: Multinomial logit analysis for the choice of work region for college graduates who studied in a peripheral region in the period 2003 – 2008.

Sample: College graduates, periphery Reference category: work in periphery	Multinomial Logit			
	Work in centre		Work abroad	
	B	Sig.	B	Sig.
Intercept	-0.47		0.74	
Gender: Female (0) Male (1)	-0.12	***	0.00	
Mean centred Age	0.05	***	0.07	***
Graduation grade [8,10]	0.04		0.28	*
Respondent born in other European country	0.18	**	1.87	***
Respondent born outside Europe	0.04		0.85	***
Interaction Born Europe*Grade >=8	-0.14		0.38	***
Interaction Born Outside Euro*Grade >=8	-0.01		-0.41	
Sector of studies is Agriculture	0.45	***	0.81	***
Sector of studies is Teaching	-0.03		0.22	*
Sector of studies is Engineering	0.29	***	0.66	***
Sector of studies is Economics	0.42	***	0.77	***
Sector of studies is Healthcare	0.11	***	0.93	***
Interaction Agri*Grade >=8	0.07		-0.21	
Interaction Teach*Grade >=8	-0.12		-0.57	**
Interaction Engin*Grade >=8	0.02		-0.18	
Interaction Econ*Grade >=8	0.10	*	0.01	
Interaction Health*Grade >=8	-0.13		-0.50	***
Mean centred Reg Econ Growth	1.34		1.03	
Mean centred Reg Unem Rate HE	3.86	**	-12.61	***
Mean centred number of higher and scientific jobs	0.63	***	-1.45	***
Control for observation window		Yes		
Time Fixed effects		Yes		
ChiSquare (DF=52)	2498.3			
Prob>ChiSq	0.00			
-LogLikelihood	17090			
N	30241			

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

The explanatory variables are based on the theoretical framework discussed earlier. Besides the previously discussed variables of ability and field of study (behavioural studies is taken as the reference category), we also include the personal variables of gender and age in the model. We also include dummies for Born in another European Country and Born outside Europe (in contrast to Born in the Netherlands as reference group) to take the possible deviations in migration behaviour due to foreign birth into account.

Because the decision to move outside the region may also be influenced by the situation on the regional labour market, we have added the variable of regional economic growth (growth in GDP) as an indicator of the general prosperity of the region. In addition, we include two variables in the model that reflect the labour market situation for graduates, more specifically: the unemployment rate among graduates and the number of higher and scientific jobs in the region. The regional variables are measured at the provincial (NUTS 2) level of the study region in order to

reflect the local conditions more accurately. To control for unobserved heterogeneity over time and space we have added time and region dummies to the model to pick up possible fixed effects. Finally, we have added a variable to the model to control for possible biases due to the fact that the interviews with the graduates show some variation over time because not all of the interviews are held exactly one-and-half years after graduation. All continuous variables were entered as a deviation of their sample means.

Table 2.2: Multinomial logit analysis for the choice of work region for university graduates who studied in a peripheral region in the period 2003 – 2008.

Sample: University graduates, periphery Reference category: work in periphery	Multinomial Logit			
	Work in centre		Work abroad	
	B	Sig.	B	Sig.
Intercept	0.26		1.02	
Gender: Female (0) Male (1)	-0.05	**	0.19	***
Mean centred Age	0.05	***	0.02	
Graduation grade [8,10]	-0.05		0.24	*
Respondent born in other European country	-0.14		1.85	***
Respondent born outside Europe	0.16	*	1.24	***
Interaction Born Europe*Grade >=8	-0.22		-0.29	**
Interaction Born Outside Euro*Grade >=8	-0.27		-0.41	**
Sector of studies is Agriculture	0.52	***	0.96	***
Sector of studies is Engineering	0.14	***	0.56	***
Sector of studies is Economics	0.41	***	0.48	***
Sector of studies is Healthcare	-0.04		-0.09	
Sector of studies is Humanities	0.19	***	0.57	***
Sector of studies is Law	0.16	***	0.04	
Sector of studies is Natural Sciences	0.08		-0.08	
Interaction Agri*Grade >=8	-0.12		-0.09	
Interaction Engin*Grade >=8	-0.06		-0.12	
Interaction Econ*Grade >=8	0.15	*	0.28	*
Interaction Health*Grade >=8	0.05		-0.10	
Interaction Human*Grade >=8	0.03		-0.36	*
Interaction Law*Grade >=8	0.18	*	0.24	
Interaction Nat Scie*Grade >=8	-0.26	**	0.28	
Mean centred Reg Econ Growth	-0.57		-4.93	***
Mean centred Reg Unem Rate HE	-13.51	***	2.92	
Mean centred number of higher and scientific jobs	-3.03	***	-3.16	***
Control for observation window				Yes
Time Fixed effects				Yes
ChiSquare (DF = 60)	2758.1			
Prob>ChiSq	0.00			
-LogLikelihood	15040			
N	17607			

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

Based on the significance of the Likelihood Ratio test, we may conclude that the overall performance for both the model for college graduates and the model for academics is very good. The controls for the differences in the interview window and the time fixed effects improve the performance of the model, whereas the regional fixed effects did not and thus are not included in the final version of the model results presented in Tables 2.1 and 2.2.

The results show that male graduates are significantly less mobile than females with regard to internal migration to the centre. For moves abroad males with a college degree do not differ significantly from females, but among university graduates males show significantly higher probabilities of moving abroad. This is in line with the results reported by Faggian *et al.* (2007a) who state that within the UK women use migration to gain access to more and better jobs as a means of partially compensating for gender differences and not because they follow men because of existing or prospective coupling arrangements.

With regard to the Age variable, some interesting differences between college and university graduates can be observed. Whereas university graduates are more likely to move to the centre when they are older, age is not significant for the move abroad. In contrast, for college graduates both variables are significant and positive. Other studies have also found mixed effects as regards this variable (for example, Faggian *et al.*, 2007b).

The findings for the variables reflecting the regional labour market situation are mixed. As was noted earlier, economic diversity in the Netherlands is low, and as such small differences could drive these results. Regional Economic Growth as an indicator for the general prosperity of the region has no significant influence on internal migration with the exception of a negative ‘keep’ effect on the likelihood of moving away from the country for the university graduates. The unemployment rate for graduates is significant in all cases except the move abroad for university graduates, but sign and size show remarkable differences between college and university graduates and move types. Higher unemployment rates in the study region lower the probability of moving to another part of the country for university graduates. For the college graduates higher unemployment rates stimulate migration within the country, but lower the probability of going abroad.

We will now discuss the multivariate outcomes for the key variables of grade, country of origin and discipline, including the interaction effects of these variables. The results for grade are largely in line with the discussed outcomes of the bivariate association shown in Figure 2.2. Those with higher grades both at college and university levels do not leave the peripheral areas to go to the centre more than those with lower grades, but they are significantly more likely to go abroad.

In our model we distinguish between graduates who were born in a European country (other than the Netherlands) and those who come from other continents. For college graduates we find that having been born outside the Netherlands significantly increases the probability of leaving the country. Moreover, we find a significant interaction effect with the graduation grade for the group that was born in another

European country, indicating that the best foreign students have an even higher probability of moving away from the Netherlands, i.e. a human capital-driven process. With respect to a move to the centre, we only find a significant effect for those born in Europe. Conversely, university graduates born outside of Europe are more likely to move to the centre after graduation. In addition, apart from similarly positive general coefficients, we find negative rather than positive interaction effects for moving abroad. In this case, the labour queue effect dominates, with the labour market for the best foreign university graduates clearing at the national level.

With regard to field of study, the results are perfectly in line with the results described in Figure 2.3. The magnitude for the significant coefficients is higher for those who go abroad than for those who move to the centre, the reference category being graduates of behavioural and social sciences. The only exception is university graduates of law, who are significantly more likely to move to the centre, but the coefficient for moving abroad is insignificant. This difference can be explained by the fact that the expertise of law students is of a much lower value in other countries due to institutional differences between countries. Students of agriculture and economics are by far the most mobile, both at university and college levels. College graduates in teaching (as far as interregional moves are concerned) and university graduates in healthcare and natural sciences do not differ significantly in spatial behaviour from the reference category of behavioural and social sciences. The coefficients for the remaining disciplines all differ significantly from the reference category.

In conclusion, we will pay some attention to the interaction effect between grade and discipline. A positive interaction effect between grade and discipline implies that for that particular discipline the best students leave, i.e. the human capital effect dominates. If the interaction effect is negative, this implies that the best students stay in the region and that the labour queue effect dominates.

For college students most interaction effects are insignificant implying that the general pattern also applies within most disciplines. The exceptions are economics with respect to a move to the centre and both teaching and healthcare regarding a move outside the Netherlands. The negative coefficients for teaching and healthcare indicate that the best graduates in these fields are less likely to go abroad and thus that the labour queue effect dominates for this particular discipline, at least at the national level. The positive interaction effect for college graduates in economics points to a human capital effect and implies that the best students are more likely to go to the centre.

For university graduates, the only significant coefficients for internal migration are found for economics (again, positive), law (also positive) and natural sciences

(negative). This indicates that the human capital effect dominates for economics and law graduates, whereas the labour queue effect is found for graduates in natural sciences. For university graduates in economics we find a significant positive effect and for university graduates in the humanities we find a significant negative effect for working outside the Netherlands, whereas no significant effects are found for the other disciplines over and above the patterns found for graduation grade and field of study in general. These results indicate that the best graduates in economics are not only more likely to leave the Periphery, they are also relatively likely to leave the Netherlands altogether, indicating that labour market opportunities for this group clear at the national or even international level. For graduates in the humanities this is an indication that the labour queue effect dominates at least at the national level.

Table 2.3: Multinomial logit analysis: predicted probabilities of moving, by field and ability for college graduates who studied in a peripheral region in the period 2003 – 2008.

College Graduates - Work Location		Born in the Netherlands			Born in other European country		
	Grade	Periphery	Centre	Abroad	Periphery	Centre	Abroad
Behavioural Sciences (ref.)							
	>=8	87%	13%	1%	52%	8%	40%
	<8	88%	12%	1%	72%	14%	14%
Agriculture							
	>=8	69%	29%	2%	25%	11%	64%
	<8	73%	25%	2%	40%	19%	41%
Teaching							
	>=8	90%	10%	0%	67%	8%	25%
	<8	88%	12%	1%	67%	12%	21%
Engineering							
	>=8	77%	22%	2%	30%	9%	61%
	<8	79%	20%	1%	47%	17%	36%
Economics							
	>=8	69%	29%	3%	20%	9%	72%
	<8	75%	24%	2%	42%	19%	39%
Health							
	>=8	86%	12%	2%	34%	5%	61%
	<8	83%	14%	3%	39%	10%	51%

In Tables 2.3 and 2.4 we illustrate the economic significance of our results by presenting the estimated probabilities of moving by field of study and level of ability; we show this separately for college and university graduates. These probabilities highlight the differences between college and university graduates, of varying fields and levels of ability, in their propensity either to stay and work in the Periphery or to move to centre or abroad. The probabilities were computed for female graduates, both those originating from the Netherlands and those originating from another European country, with all continuous individual and regional economic control variables as their sample means.

The tables illustrate the results we discussed earlier. For example, from Table 2.3 it becomes clear that the best Dutch graduates in economics are 6 percentage points less likely to work in the Periphery than their less-talented counterparts. For the subjects of teaching and healthcare we find opposite patterns. In general, graduates born in another European country are very likely to move abroad (return migration). A striking result is the dominance of human-capital-driven mobility away from the country for foreign graduates: those with higher grades are consistently more likely to move abroad, across all disciplines.

Table 2.4: Multinomial logit analysis: predicted probabilities of moving, by field and ability for university graduates who studied in a peripheral region in the period 2003 – 2008.

University Graduates - Work Location							
	Grade	Born in the Netherlands			Born in other European country		
		Periphery	Centre	Abroad	Periphery	Centre	Abroad
Behavioural Sciences (ref.)							
	>=8	73%	24%	3%	46%	7%	47%
	<8	72%	26%	2%	42%	12%	47%
Agriculture							
	>=8	51%	36%	13%	14%	5%	81%
	<8	45%	46%	9%	11%	8%	81%
Engineering							
	>=8	67%	26%	7%	28%	5%	67%
	<8	64%	31%	6%	21%	8%	72%
Economics							
	>=8	46%	45%	9%	16%	8%	76%
	<8	53%	43%	4%	22%	14%	64%
Health							
	>=8	73%	24%	2%	54%	9%	38%
	<8	74%	25%	2%	46%	12%	43%
Humanities							
	>=8	64%	32%	4%	36%	9%	55%
	<8	62%	33%	5%	20%	8%	72%
Law							
	>=8	58%	37%	5%	33%	10%	57%
	<8	66%	33%	2%	39%	15%	47%
Natural Sciences							
	>=8	77%	17%	5%	38%	4%	58%
	<8	69%	29%	2%	44%	14%	42%

From Table 2.4 it becomes clear that, in general, university graduates are more mobile than college graduates. Across disciplines, the probabilities of staying in the peripheral regions are 10-20 percentage points lower than for the respective college counterparts. Dutch graduates in economics, law and agriculture are the most mobile. Foreign work locations are more likely for the best Dutch graduates and this constitutes a second important difference from the patterns found for the college graduates. With respect to university graduates who were born abroad, the patterns differ substantially between disciplines, with economics, law and natural sciences displaying patterns according to the human capital model, whereas the other disciplines have a stronger labour queue profile, the opposite of the findings for the

college graduates. This is particularly interesting in the case of natural sciences, since this pattern is the opposite of that of the Dutch graduates.

2.5 Conclusion and discussion

In the literature there is more and more empirical evidence to show that the presence of highly skilled people in a region is an important determinant of economic growth. Consequently, policymakers are eager to try to keep highly skilled people in the region or attract them from elsewhere. It is also well known that people who have been through further education exhibit high spatial mobility rates. Much less is known about the mobility patterns by discipline and by grade. Do the best people leave or stay, and does this vary by discipline and type of region? In this chapter, we investigated the relationship between ability, field of study and spatial mobility, using a micro-dataset of Dutch university and college graduates. The findings indicate that there are substantial net flows mainly towards the economic centre of the Netherlands, but there are also flows between peripheral regions and to other countries. This, however, does not necessarily mean that peripheral regions also lose their best graduates.

We find that university graduates are more spatially mobile than college graduates. Those with higher grades both at college and university levels do not leave the peripheral areas to go to the centre more than those with a moderate grade, but they are significantly more likely to go abroad. There are also striking differences between graduates in their spatial behaviour by discipline. Students in agriculture and economics are by far the most mobile, both at university and college levels. Peripheral retention of graduates differs substantially between fields of study. College graduates in teaching and university graduates in natural sciences are the least mobile together with the reference category of graduates in behavioural and social sciences and graduates in healthcare. As such, grade is only clearly related to a move abroad, where stronger selectivity according to ability is apparent from the analysis. Furthermore, moving abroad is strongly linked to the respondent's own nationality: foreign graduates are far more likely to work outside the Netherlands. Within this group, however, distinct differences can be observed with respect to the relationship with graduation grade.

The interaction effects of grade and discipline allow us to find out whether the best students in a particular discipline stay or leave the region and to test whether the human capital or the labour queue model dominates. For college graduates we find the best teachers and healthcare graduates are less likely to leave the country and thus that the labour queue effect dominates for this particular discipline, at least at the national level. Conversely, the positive interaction effect for college graduates in economics

points to a human capital effect and implies that the best students are more likely to go to the centre.

For university graduates we find significant interaction effects for internal migration for economics, law (human capital) and natural sciences (labour queue). For university graduates in the humanities we find a significant negative effect for working outside the Netherlands, but no significant effects for internal migration. These results indicate that the best students in this field are less likely to leave the country, although they are not necessarily retained in the study region. This is an indication that the labour queue effect dominates at the national level at least. The reverse is true for the graduates in economics: the positive coefficients indicate that there is a significantly higher probability of the best students moving abroad.

In general, we may conclude that there is little evidence that the best graduates necessarily leave the Dutch peripheral study regions, as the human capital model of migration seems to dictate. The internal migration of graduates is only weakly related to ability as such, with foreign migration being the only exception. This indicates that, at either the national or even the interregional level, the job-competition model dominates in a number of fields rather than the human capital model, because the best students stay and employers in the region or the country are able to recruit the best students. The only exception is economics, where the best college students tend to move significantly more often to the centre and the best university graduates move abroad. In this case, the human capital model dominates, as economists appear to maximize their human capital on a worldwide scale.

Another interesting finding is that, in general, male graduates are significantly less mobile than female graduates. This supports the results reported by Faggian *et al.* (2007a), who state that women use migration to gain access to more and better jobs as a means of partially compensating for gender differences and not because they follow men because of existing or prospective coupling arrangements.

These findings clearly provide interesting options for local policymakers and employers. Migration is costly, and jobseekers are inclined to value the options they have nearby more than similar options further away. Graduates who have selected a more peripheral institution of higher education may not place the same value on the typical urban amenities found in the centre as those who selected a more central study region to begin with. Furthermore, institutions of higher education provide a suitable mechanism by which to judge the productivity, observed or unobserved, of a candidate: a diploma with a designated field and grade. However, universities situated in the periphery are also potential employers. They are well placed to select the best graduates from their respective cohorts as employees in the form of PhD students. As

we find labour-queue effects both for college and selected university disciplines, we do not suspect that this particular mechanism is the main driving force behind our results. In general, other potential employers could respond to this local availability of both certain amenities and the supply of and information about graduates and relocate jobs towards regions that meet these criteria (i.e. ‘jobs-follow-people’). This chapter has demonstrated that the quest for the job candidate with the highest level of education does not necessarily start in the economic centre.

References

- Barro, R.J. and X. Sala-i-Martin (1995) *Economic growth*. McGraw-Hill, New York.
- Bartel, A.P. (1979) The Migration Decision: What role does job mobility play? *The American Economic Review* 69(5), 775-786.
- Becker, G. (1964) *Human Capital*. Columbia University Press: New York.
- Berry, C.R. and E.L. Glaeser (2005) The divergence of human capital levels across cities. *Papers in Regional Science* 83(3), 407-444.
- Coniglio, N.D. and F. Prota (2008) Human capital accumulation and migration in a peripheral EU region; the case of Basilicata. *Papers in Regional Science* 87(1), 77-96.
- Détang-Dessendre, C. (1999) Reciprocal link between exit from unemployment and geographical mobility. *Environment and Planning A* 31, 1417-1431.
- Faggian, A., P. McCann and S. Sheppard (2007a) Some Evidence that Women are More Mobile than Men: Gender Differences in UK Graduate Migration Behavior. *Journal of Regional Science* 47(3), 517-539.
- Faggian, A., P. McCann and S. Sheppard (2007b) Human capital, higher education and graduate migration: an analysis of Scottish and Welsh students. *Urban Studies* 44(13), 1-18.
- Faggian, A. and P. McCann (2008) Human capital, graduate migration and innovation in British regions. *Cambridge Journal of Economics* 33(2), 317-333.
- Faggian, A. and P. McCann (2009a) Human Capital and Regional Development. In: R. Capello and P. Nijkamp, *Handbook of Regional Growth And Development Theories*, Edward Elgar: Cheltenham, UK, 133-151.
- Faggian, A. and P. McCann (2009b) Universities, Agglomerations and Graduate Human Capital Mobility. *Tijdschrift voor Economische en Sociale Geografie* 100(2), 210-223.
- Fielding, A.J. (1992) Migration and Social Mobility: South East England as an Escalator Region. *Regional Studies* 26(1), 1-15.
- Heijke, H. and M. Koeslag (1999) The Labour-market Position of University Education and Higher Vocational Education in Economics and Business Administration: a comparison. *Education Economics* 7(3), 259-276.
- Hensen, M.M., R.M. De Vries & F. Cörvers (2009), The role of geographic mobility in reducing education-job mismatches in the Netherlands. *Papers in Regional Science* 88(3), 667-683.
- Herzog Jr., H.W., A.M. Schlottmann and T.P. Boehm (1993) Migration as Spatial Job-search: A Survey of Empirical Findings. *Regional Studies* 27(4), 327-340.
- Kırdar, M.G. and D.S. Saracoglu (2008) Migration and regional convergence: An empirical investigation for Turkey. *Papers in Regional Science* 87(4), 545-567.

- Lippman, S.A. and J.J. McCall (1976) The Economics of job search: a survey (Part I), *Economic Inquiry* 14(2), 155–189.
- Lippman, S.A. and J.J. McCall (1979) *Studies in the economics of search*. Amsterdam, North-Holland.
- Lucas, R.E. (1988), On the mechanics of economic development. *Journal of Monetary Economics* 22, 3-42
- Nijkamp, P. and J. Poot (1998) Spatial perspectives on new theories of economic growth. *Annals of Regional Science* 32, 7-37.
- Pellenbarg, P. and P. Van Steen (2009) Place and Science in The Netherlands. A Spatial Perspective on Dutch Universities and their Knowledge Output. *Tijdschrift voor Economische en Sociale Geografie* 100(5), 686-693.
- Pissarides, C.A. (1976) Job Search and Participation. *Economica* 43(169), 33-49.
- Ritsilä, J. and M. Haapanen (2003) Where Do the Highly Educated Migrate? Micro-level Evidence from Finland. *International Review of Applied Economics* 17(4), 437-448.
- Romer, P.M. (1990) Endogenous Technological Change. *The Journal of Political Economy* 98 (5, Part 2: The Problem of Development: A Conference of the Institute for the Study of Free Enterprise Systems), S71-S102.
- Sjaastad, L.A. (1962) The Costs and Returns of Human Migration. *The Journal of Political Economy* 70 (5, Part 2: Investment in Human Beings), 80-93.
- Thurow, L.C. (1975) *Generating Inequality*. Basic Books Inc.: New York
- van Dijk, J. (2007) The Regional Labour Market: Braindrain or Knowledge Export? In: G. Ashworth, P. Groote and P. Pellenbarg (eds) *A Compact Geography Of The Northern Netherlands*. In Boekvorm Uitgevers.
- van Ham, M., C.H. Mulder and P. Hooimeijer (2001) Spatial flexibility in job mobility: macrolevel opportunities and microlevel restrictions. *Environment and Planning A* 33, 921-940.
- van Ours, J.C. and G. Ridder (1995) Job matching and job competition: Are lower educated workers at the back of job queues? *European Economic Review* 39, 1717-1731.

Appendix 2.A: sample statistics

Table 2.A.1: Sample statistics.

Study region = Periphery	College				University			
	Work in periphery	Work in centre	Work abroad	Total	Work in periphery	Work in centre	Work abroad	Total
Gender: Female (0) Male (1)	0.41	0.43	0.44	0.42	0.46	0.49	0.56	0.48
Age at time of interview	24.23	24.41	24.81	24.28	25.87	26.00	26.17	25.93
Graduation grade [8,10]	0.20	0.19	0.28	0.20	0.20	0.17	0.32	0.20
Respondent born in other European country	0.01	0.01	0.32	0.02	0.02	0.01	0.36	0.04
Respondent born outside Europe	0.01	0.01	0.03	0.01	0.01	0.01	0.06	0.01
Interaction Born Europe*Grade >=8	0.00	0.00	0.14	0.01	0.01	0.00	0.14	0.01
Interaction Born Outside Euro*Grade >=8	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Sector of studies is Agriculture	0.06	0.10	0.09	0.07	0.08	0.12	0.20	0.10
Sector of studies is Teaching	0.16	0.09	0.04	0.14				
Sector of studies is Engineering	0.19	0.19	0.19	0.19	0.18	0.18	0.17	0.18
Sector of studies is Economics	0.29	0.42	0.38	0.32	0.17	0.26	0.31	0.21
Sector of studies is Healthcare	0.12	0.09	0.24	0.12	0.13	0.09	0.06	0.12
Sector of studies is Behavioural & social sciences (Reference cat.)	0.17	0.11	0.05	0.16	0.21	0.15	0.10	0.18
Sector of studies is Arts, language & culture					0.08	0.08	0.09	0.08
Sector of studies is Law					0.10	0.10	0.05	0.10
Sector of studies is Natural Sciences					0.05	0.03	0.02	0.04
Interaction Agri*Grade >=8	0.01	0.01	0.02	0.01	0.02	0.02	0.07	0.02
Interaction Teach*Grade >=8	0.05	0.03	0.01	0.05				
Interaction Engin*Grade >=8	0.04	0.04	0.05	0.04	0.05	0.04	0.06	0.05
Interaction Econ*Grade >=8	0.04	0.07	0.10	0.05	0.02	0.03	0.10	0.03
Interaction Health*Grade >=8	0.02	0.02	0.07	0.02	0.04	0.02	0.02	0.03
Interaction Behav Sc*Grade >=8 (Reference cat.)	0.04	0.02	0.02	0.03	0.03	0.02	0.03	0.03
Interaction Letters*Grade >=8					0.02	0.02	0.02	0.02
Interaction Law*Grade >=8					0.01	0.01	0.01	0.01
Interaction Nat Sc*Grade >=8					0.01	0.01	0.01	0.01
Reg Econ Growth (%/100)	0.022	0.023	0.022	0.022	0.02	0.02	0.02	0.02
Graduate Unemployment Rate (%/100)	0.048	0.049	0.047	0.048	0.04	0.04	0.04	0.04
# Higher and Scient. Jobs (/1000000)	0.196	0.199	0.190	0.196	0.18	0.17	0.17	0.18
# Months between graduation and questionnaire	17.80	17.94	18.01	17.83	18.32	18.65	18.22	18.43
Dummy 2003	0.13	0.14	0.13	0.13	0.17	0.17	0.10	0.17
Dummy 2004	0.19	0.19	0.16	0.19	0.18	0.16	0.13	0.17
Dummy 2005	0.16	0.17	0.20	0.17	0.17	0.16	0.15	0.17
Dummy 2006	0.18	0.18	0.19	0.18	0.19	0.20	0.20	0.19
Dummy 2007	0.14	0.15	0.13	0.14	0.16	0.18	0.23	0.18
Dummy 2008 (Reference cat.)	0.20	0.18	0.20	0.20	0.13	0.12	0.20	0.13
N	23809	5484	948	30241	10416	6058	1133	17607
%	0.79	0.18	0.03	1.00	0.59	0.34	0.06	1.00

3. An analysis of trends in spatial mobility of Dutch graduates

ABSTRACT⁴ - Considerable attention in the literature has been devoted to spatial mobility as a mechanism in the transition from study to work. In this Chapter, the relationships between migration and both regional economic circumstances and individual characteristics are investigated using a micro-data set on Dutch college and university graduates. Over the last decade, some Dutch regions have retained increasingly higher proportions of college graduates. We find that the presence of a large labour market is the most important structural economic determinant for these higher retention rates. Cyclical determinants appear to affect graduate migration from universities more than from colleges.

Keywords: Internal Migration, Regional Labour Markets, Human Capital, Graduates

JEL Classification: R23; J24; J61

3.1 Introduction

Considerable attention has been paid in the literature to the determinants of migration. Especially the location choice of the highly skilled has been studied from a variety of perspectives. The literature on endogenous growth (Lucas, 1988, Romer, 1990) stresses the importance of learning and skills in regions. Glaeser and Saiz (2004) describe why skilled cities in the United States have done so well in this respect. Similarly, other literature has focussed on the role of institutions of higher education in regions in relation to regional economic growth. It seems that, in their respective regions, cities that have institutions for higher education within their borders may serve as a doorway for the surrounding region (Fielding, 1992). In the typical situation,

⁴ Reprinted from: Venhorst, V.A., J. van Dijk and L.J.G. van Wissen (2011) An analysis of trends in spatial mobility of Dutch graduates. *Spatial Economic Analysis*, 6 (1), pp. 57-82.

prospective students are attracted to a city and its education opportunities. After graduation, they then capitalise on the investment they have made in their human capital. Faggian and McCann (2006) investigated whether economic spillover results from higher education institutions in the United Kingdom and find little evidence of direct effects. While the main function of institutions of higher education appears to be guiding talented young individuals into a region, retaining these individuals within the region is not a given. Various studies, for example Gottlieb and Joseph (2006) for the United States and Détang-Dessendre (1999) for France, indicate that, especially for younger individuals, economic considerations are of major importance in location decisions.

In this study, we investigate the effect of various economic characteristics on the migration of Dutch graduates using a recent dataset spanning 1997 - 2008. Our findings indicate that the availability of a large labour market is a key factor in location decisions made by Dutch graduates. However, alongside this rather structural element, we find a variety of effects of a more cyclical nature. Thirdly, our findings indicate that, over time, graduates are becoming less spatially mobile. This trend is explained by regional economic developments rather than by the background characteristics of individual graduates.

The structure of this chapter is as follows. In Section 3.2 we discuss the literature on the mobility of individuals with a high human capital, and highly-educated graduates specifically, in relation to general economic circumstances. In Section 3.3, we describe our data and methods, followed by a multivariate analysis in Section 3.4. Section 3.5 discusses our findings, and our conclusions are reported in Section 3.6.

3.2 Literature review

In the literature, migration has been approached from both an equilibrium as well as a disequilibrium point of view (Hunt, 1993). Graves and Linneman (1979), adopting the former view, see migration as being driven by changes in preferences for what they refer to as ‘non-tradable goods’ i.e. site-specific amenities. Dynamics at the level of individual households, or indeed individual workers, may lead to changes in location preferences, and henceforth to migration if this change satisfies a sufficiently strong preference for goods or a quality of life that cannot be obtained in the current location.

Conversely, in a disequilibrium framework, migration occurs when there are regional disparities in, for example, income levels or labour market opportunities. Under certain assumptions, the flow of labour from one region to another is then

thought to serve as an equalising force (Greenwood, 1975). Sjaastad (1962) found that migrants responded to income differentials between regions in a US study. However, he questioned whether the ensuing flows were really sufficient to equalise labour market differentials across the economy. This led him to the conclusion that costs and benefits are key to the functioning of such a system: what is the 'return on investment' that an individual migrant may expect from moving, and how does that relate to regional differences in income levels? More often than not, in these types of studies, migration is linked to changes in the status of the labour market. Bartel (1979) points out that the relationship between migration and income differentials may even hinge on the type of labour market change that is underlying the move, be it redundancy or a more voluntary change.

Others, including Clark and Cosgrove (1991), have shown that both approaches can contribute to explaining migration. The relative importance of these distinct approaches however remains a source of debate in the literature. This debate centres on the sources of urban growth and, more specifically, the potential of cities to attract highly skilled workers. Relatively recently, Gleaser and Gottlieb (2006) have provided evidence that the availability of amenities plays a crucial role in attracting highly skilled people and the authors introduce the concept of "consumer cities". However, Storper and Scott (2009) criticise the dominant role attributed to amenities, and Scott (2010) states that employment opportunities outweigh amenities in determining the spatial behaviour of engineers in the US. Partridge (2010) compares their work with the performance of New Economic Geography, and the amenity-based approach, in explaining post-war growth rates in the more-peripheral areas of the United States, and concludes that the growth patterns are predominantly amenity-driven.

From the perspective of the individual migrant, the relative importance of economics or amenities is likely to be determined by their stage in the life course as well as their level of human capital. It is now generally accepted from a theoretical point of view, and confirmed in many empirical studies, that migration is dependent on age (see for instance the review by Plane, 1993). Young people might be more mobile because they are starters in the labour market, and may also move to find a partner. From the human capital theory viewpoint, young people might be more willing to migrate because they have a longer potential payback period to see a return on such investments than older people do. The peak in propensity to migrate occurs in one's early twenties and steadily declines thereafter. Given the patterns found, alongside age, age-squared is also often used in empirical studies. In their study of Italian graduates, Coniglio and Prota (2008) indeed found significant effects for age (positive) and for age² (negative). Whisler *et al.* (2008) relate back to the more equilibrium, or amenity-driven, approaches to migration research and show, for an American sample, how the

outmigration probabilities of individuals with high human capital change along the life course as a result of shifting preferences.

In recent years, an important focus in migration research has been on the mobility of young individuals with high human capital, i.e. higher education graduates. Faggian *et al.* (2006, 2007a, 2007b) studied graduate migration in the United Kingdom, focussing on differences between the genders, ethnic minorities and institutional explanatory variables. Haapanen and Tervo (2009) have studied the effect of residence duration with a sample of Finnish graduates spanning 1991 – 2003. They found that the propensity to move is especially high during the graduation year and for up to two years thereafter. It could be argued that it is precisely these higher rates of mobility for new graduates that make such individuals so sought after. In their phase in the life course, location decisions are made which may be influenced by policy. However, attracting students to a region does not guarantee success, as was shown by Hansen *et al.* (2003) who discussed the problems that the Pittsburgh region was having in retaining graduates for the local labour market. A survey among ‘stayers’ pointed towards regional economic conditions, opportunities for further education and low-cost housing as important “keep” factors. Push factors were a lack of advancement options and few opportunities for women and those from minority groups. Gottlieb and Joseph (2006) apply a mixed logit model to the migration of American technical graduates and doctorate holders and found that amenities are more important for the latter group. The authors point to the relative economic independence, or bargaining power based on their unique human capital, of these doctorate holders as a possible explanation for the weaker effects of labour market characteristics. They also found that amenities play a relatively weak role in graduate migration.

From the above, it seems that, especially for young graduates, regional and wider economic conditions are a key element in mobility and location decisions. Adverse regional and national economic circumstances may stimulate spatial mobility, as migrants may need to search further afield for work. For Canada, Coulombe (2006) found that interprovincial migration was primarily driven by structural rather than cyclical factors. Migration, for all age groups, tends to flow from areas with fewer job opportunities and lower productivity levels to more urbanised areas. Conversely, very little effect on migration was found for what are referred to as asymmetric shocks, or short-term economic opportunities and threats. The author points to the cost of migration as an explanation: “Canadians ... do not propose structural responses (migration) to solve short run problems” (Coulombe, 2006, p. 219). Van der Gaag and Van Wissen (2008) studied the determinants of internal migration rates in a range of European countries, including the Netherlands. In their study, the hypothesis that migration increases in times of economic upswing was supported, albeit to a limited

extent. The authors found a stable and positive relationship between migration rates and GDP per capita levels, alongside a somewhat weaker negative relationship between migration and unemployment rates.

Some studies have focussed more specifically on unemployment, and have shown that unemployment does not always lead to higher levels of mobility, due to what is referred to as the “discouraged worker effect” (Van Ham *et al.*, 2001). In such a situation, an unemployed worker will exert less spatial search effort, assuming that efforts are futile on the premise that circumstances are bad everywhere. Détang-Dessendre (1999) investigated whether migration is an attempt to end unemployment, or whether migration is driven by a known new job, using a sample of French youth. She found that most migration was contract bound, and that migration by the unemployed does not always help to change their situation. Effects differed depending on the training level, with the highly-trained often needing to move in order to find suitable employment. Alongside this work influence, some are bound to a region, for example by home ownership (Helderman *et al.*, 2006), and this potentially keeps the unemployed from leaving their regions. Antolin and Bover (1997) showed that, in Spain, recipients of unemployment benefits are less likely to move, with regional unemployment only serving as a push factor for those unemployed and not on benefits.

Overall, therefore, especially when considering Europe, results are somewhat mixed. Further, early studies (Blanchard and Katz, 1992, Decressin and Fatás, 1995) have shown that, for European countries, adjustment after a labour demand shock is achieved primarily through changing participation rates rather than migration, unlike in the United States where spatial mobility is the prime adjustment mechanism. Broersma and Van Dijk (2002) found that the Netherlands fitted this ‘European’ pattern.

Nevertheless, effort put into spatially searching may serve to increase the probability of a good match on the labour market (Büchel and Van Ham, 2003). Hensen *et al.* (2009) show that, for the Netherlands, school leavers who are spatially more mobile obtain better job-matches than those who stay in the region of study. However, the extent of search success does not depend on effort or on regional economic characteristics alone. Several studies point to individual characteristics as equally, or even more, important in determining labour market outcomes. Pekkala and Tervo (2002) show that a successful outcome depends primarily on unobserved personal characteristics, or endogenous migrant selectivity, and not on the move as such. Venhorst and Cörvers (2010) show that controlling for self-selection all but negates the apparent effect of spatial mobility on the quality of the job match in a sample of Dutch graduates. Détang-Dessendre *et al.* (2004) found that highly educated French people self-select migration into opportunity-rich regions.

In this chapter, we focus on the relationship between spatial mobility and regional economic characteristics using a sample of recent Dutch college and university graduates. The Dutch higher education system is split between universities and vocational colleges (HBOs). Universities as a group are comparable to the research universities in the United States context. The HBOs are more comparable to the United States' four-year colleges, or polytechnics in many countries. We use the terms 'university' and 'college' to refer to these two layers in the Dutch higher education system which are analysed separately in this Chapter. Earlier research has shown that university graduates are more spatially mobile than college graduates (Venhorst *et al.*, 2010). We would therefore expect college graduates to be more affected by regional economic developments than their more 'footloose' university counterparts.

We have seen that young individuals are particularly spatially mobile and that, for this group, economic considerations play an important role, notwithstanding the fact that the role of these economic considerations may be driven by unobserved individual characteristics. It has been found that over 70% of college graduates find employment at higher or scientific levels (Allen *et al.*, 2009). The number of jobs at this level in the study region is therefore thought to be an important 'keep' factor, and is expected to relate negatively to the probability of spatial mobility. Alongside this, we would also expect relatively favourable regional economic circumstances to translate into lower outmigration rates among graduates. However, as it has become clear from the previous research, the business cycle generally has little effect on migration. Amenity-based approaches have highlighted the need to take into account a desire to live in certain regions. In this study, desirability is operationalised as the average regional housing price. The Dutch housing market is highly institutionalised and can be characterised as inelastic. In this situation, the level of housing prices can reflect both the lack of stock-responsiveness to demand shocks, as well as demand for living in specific regions. As such, it can also be thought of as a push factor, in the sense that the high costs of living may be prohibitive for some. In this sense, it is not obvious whether positive or negative effects on migration can be expected.

In this chapter, we control for both demographic characteristics as well as for factors associated with the graduates' degree programmes, as some of these factors may be expected to impact, either directly or indirectly, on the relationship between economic circumstances and migration. Men and women differ in subject choice, and logically therefore also in the ensuing need to be spatially mobile to compensate for potential labour market disadvantages (Faggian *et al.*, 2007b). Further, for the Dutch situation, it is anticipated that graduates from ethnic minorities will be less spatially mobile given their perceived attachment to a limited number of large cities in the west

of the country. Venhorst *et al.* (2010) however do show that these graduates are more likely than native students to move abroad. Particularly for research which includes moving abroad as an option, this is an important control variable.

Venhorst *et al.* (2010) also demonstrate that there are substantial differences in the tendency to be spatially mobile among the possible fields of study. The best graduates who have studied teaching are less likely than other teaching graduates to move to the central economic area in the Netherlands. Conversely, graduates in engineering subjects and economics are more focussed on moving to the economic centre of the country, especially the best economic students. For such students, completing an internship or having relevant work experience facilitates the transition from study to work. This could lead to a reduction in search effort, including in a spatial sense. Conversely, it could lead to a reduction in the risks associated with a move over greater distances, and therefore stimulate spatial mobility. Enrolling in further education may or may not entail spatial mobility. In the Netherlands, most university bachelor students who go on to pursue a master programme stay at the same university, a decision mostly related to institutional factors. Key to this process is the efficient links between existing bachelor and master programmes within an institution, or sometimes with other close-by colleges. Courses available in the present study area may also be preferred to potentially better tuition elsewhere as a result of mobility costs. Therefore we expect a relatively low level of spatial mobility for those currently passing through the further education system.

Having considered various factors that we think might influence migration; we weigh these factors against each other in a multivariate analysis of graduate migration. We use data that enable us to study the effects of regional economic circumstances on graduate migration over the period 1997 – 2008, while taking into account a variety of factors at the level of individual graduates. Focussing on this recent decade provides an opportunity to study the effects of an economic recession as the Netherlands experienced such a downturn between 2001 and 2005. In the next section, we present our data and our measure for spatial mobility. We then present the independent variables for this analysis and the related hypotheses regarding their expected effects on graduate mobility.

3.3 Data and Methods

3.3.1 Data

Our analysis draws on the ROA School-leaver Information System (ROA-SIS), which contains data from the HBO- and WO- monitors of recent Dutch college and university

graduates. For this survey, graduates are interviewed approximately 18 months after graduation. In the survey, information is collected pertaining to both the study period and current employment. The survey can be characterised as an annually repeated cross-section approach, able to provide us with data spanning the period 1997 to 2008, or, to look at it another way, graduation years from 1995-1996 up to and including 2006-2007. For university graduates, this sample has been restricted to the data-collection years 1998 – 2007, since not all universities participated in the excluded cycles.

As noted previously, this period allows us to study the effects of economic recession on migration. From the data, we have selected students aged 30 or less at the time of graduation who had undergone full-time study. Older graduates, as well as those having followed part-time education, often exhibit socioeconomic characteristics that are quite different from the more ‘standard’ graduate entering the labour market and, as a result, their migration patterns, and presumably the factors that drive their spatial mobility, are expected to differ considerably from our sample and were therefore excluded to avoid confounding factors. These selection criteria left us with a sample of over 120,000 college graduates and over 63,000 university graduates, spread throughout the aforementioned years. In the following subsections we will introduce our measure of spatial mobility and the explanatory variables. Sample statistics are provided in Tables 3.1 – 3.4.

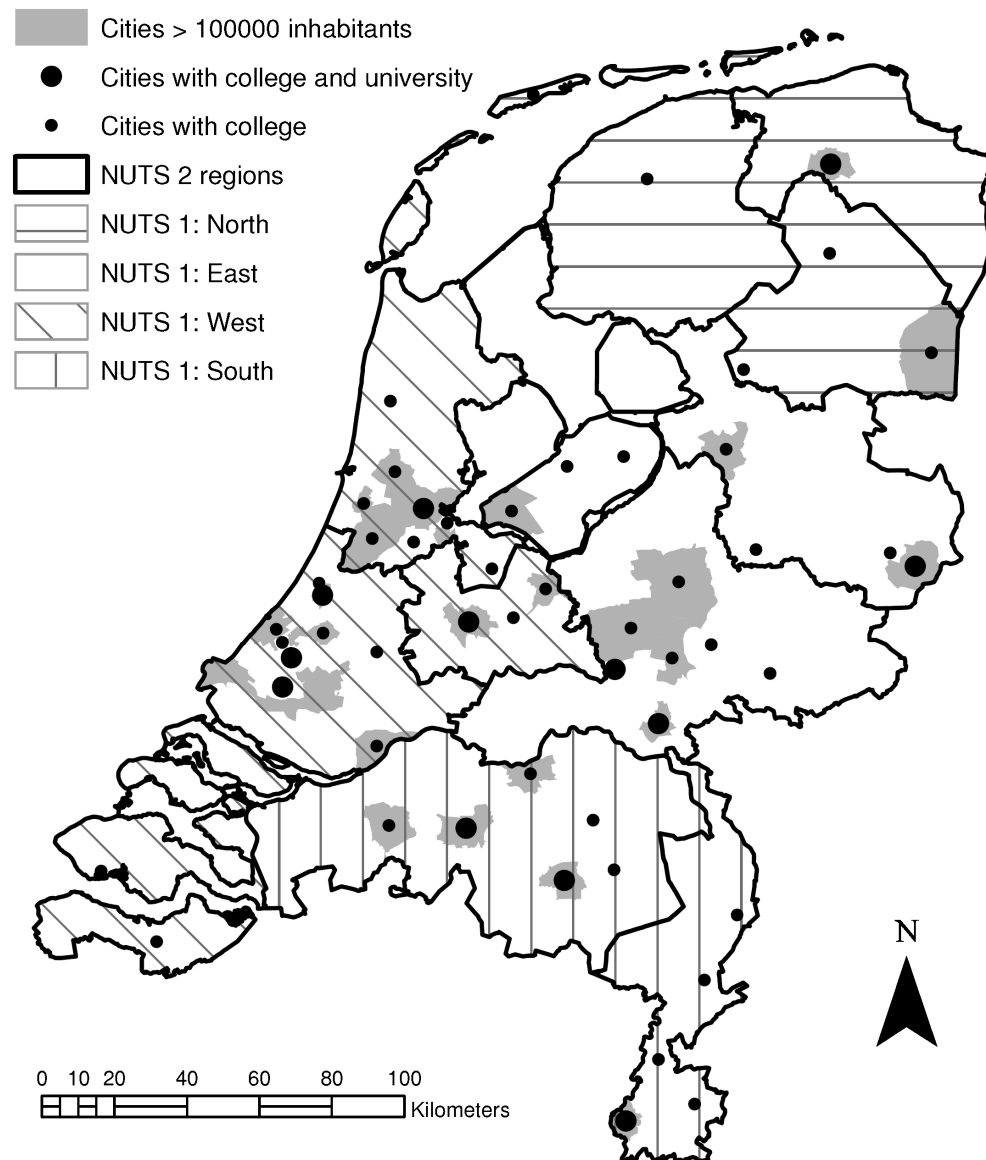
3.3.2 Measuring spatial mobility

In this study, we consider a graduate to be spatially mobile if their working NUTS 2 region at the time of the interview was different from that in which they had studied. In Figure 3.1, we present a map of the Netherlands, which marks the delineation of the NUTS 1 and NUTS 2 regions, as well as the locations of institutions of higher education. The Netherlands consists of four NUTS 1 regions (North, East, West and South) which are further subdivided into a total of twelve NUTS 2 regions. We distinguish four possible moves: ‘Remaining in the NUTS 2 study region’; ‘Moving within the NUTS 1 study region’ (i.e. working in a different NUTS 2 region but the same NUTS 1 region as where one studied); ‘Moving to a different NUTS 1 region’ and ‘Moving Abroad’. In so doing, we do not consider either the possibility of commuting from current residence to current work (across NUTS boundaries), or whether the graduate had to move house in making the transition from study to work. The classification applied in this study is based on administrative regions rather than functional, or labour market, regions. Cörvers *et al.* (2009) investigated under which circumstances functional regions would be preferable to administrative regions for such studies. Based on their findings, we concluded, for the Netherlands and for the

economic indicators of interest, that administrative regions would not perform significantly worse than functional or labour market regions.

For reasons of conciseness, in Tables 3.1 and 3.2, for the categories given, the sample incidences are presented both over time as well as averaged across NUTS 1 study regions, rather than the NUTS 2 study regions that are the true focus of this Chapter.

Figure 3.1: Map of the Netherlands: NUTS 1 and NUTS 2 regions, location of major cities, colleges and universities.



From the tables it can be seen that Dutch university graduates are more spatially mobile than college graduates (see also Venhorst *et al.*, 2010). In our sample of Dutch graduates, about 42% of the college graduates and about 55% of the university graduates left their NUTS 2 study region after graduation. Further, around one-quarter of the college graduates leave the larger NUTS 1 region, compared to approximately one-third of the university graduates who move to another NUTS 1 region or go abroad. From Table 3.1 (college graduates) it can be seen that the share of college graduates who remain in their NUTS 2 study region has increased slightly over time, from roughly 56% at the beginning to about 59% at the end of the research period. Logically, the share of graduates that moves between NUTS 1 regions shows a slight decline. In Table 3.2, we see a similar slight increase in the proportion of university graduates staying in their NUTS 2 study region during the recession years of 2001 – 2005, and also a growth in numbers moving abroad.

Table 3.1: Spatial mobility of college graduates, sample incidence. Source: ROA-SIS 1997 – 2008, own computations.

	Stay in NUTS 2 study region	Move Within NUTS 1 study region	Move Between NUTS 1 regions	Move Abroad
Total	58%	17%	23%	3%
<i>Over time:</i>				
1997	55%	16%	25%	4%
1998	56%	16%	25%	3%
1999	56%	17%	25%	3%
2000	56%	17%	25%	2%
2001	57%	18%	23%	2%
2002	59%	17%	23%	2%
2003	61%	16%	21%	2%
2004	58%	17%	21%	3%
2005	58%	15%	24%	3%
2006	58%	17%	22%	3%
2007	58%	17%	22%	3%
2008	60%	16%	21%	3%
<i>By NUTS 1 study region</i>				
North	42%	21%	35%	3%
East	46%	16%	35%	3%
West	66%	20%	12%	2%
South	60%	10%	26%	4%

Tables 3.1 and 3.2 indicate however that there are considerable regional variations. Figure 3.1 includes the locations of the cities with more than 100,000 inhabitants because higher and scientific level jobs tend to be concentrated in these cities. Generally, our findings indicate that graduate retention rates are higher in those regions which feature the ‘opportunity-rich’ larger cities. Overall, for the Dutch situation, it is clear that graduate migration is largely regional: relatively large numbers of graduates work reasonably close to where they studied. This is particularly true for

graduates in the region NUTS 1: West, which contains the four largest cities in the Netherlands.

Table 3.2: Spatial mobility of university graduates, sample incidence. Source: ROA-SIS 1998 – 2007, own computations.

	Stay in NUTS 2 study region	Move Within NUTS 1 study region	Move Between NUTS 1 regions	Move Abroad
Total	45%	20%	30%	4%
<i>Over time:</i>				
1998	45%	19%	33%	4%
1999	43%	20%	35%	3%
2000	44%	20%	32%	4%
2001	45%	21%	31%	3%
2002	47%	20%	30%	3%
2003	47%	18%	31%	4%
2004	47%	19%	30%	4%
2005	47%	20%	29%	5%
2006	45%	21%	28%	6%
2007	44%	21%	29%	6%
<i>By NUTS 1 study region</i>				
North	26%	13%	58%	3%
East	32%	6%	57%	4%
West	55%	29%	13%	4%
South	42%	10%	42%	6%

3.3.3 Explanatory variables

From the literature review it was clear that migration is related to demographic characteristics alongside factors related to the graduates' study periods. Our data, enriched with data from Statistics Netherlands, are sufficiently detailed to enable us to control for these factors. Summary statistics can be found in Tables 3.3 and 3.4 for college and university graduates respectively.

3.3.3.1 Demographic controls

In our analysis, we control for a range of demographic characteristics. The sample contains a majority of women (41% of the college graduates were male, 47% of the university graduates). The average age at the time of interview was around 24.5 years for the college graduates whereas university graduates were slightly older (26.1 years). Apart, in some cases, from longer nominal study durations, this difference reflects the fact that university enrolment starts at age 18 whereas students can enrol in colleges from the age of 17.

About 6% of the college graduates were born outside the Netherlands, or have at least one parent born outside of the Netherlands. Regrettably, comparable information is not available for the university graduates for the full period of the sample. Using the data for the college graduates, we ran a sensitivity analysis which

indicated that although this factor was significant, ignoring it when running the analysis did not affect the results for our key variables (see Appendix 3.A).

3.3.3.2 Study controls

‘Behavioural and social sciences’ was selected as the model reference category for both university and college graduates since earlier work has shown that graduates in this field are generally the least spatially mobile (Venhorst *et al.*, 2010).

Almost all (98%) college graduates completed an internship during their studies. This variable is not recorded for the university graduates over the full length of our sample but, as above, sensitivity analysis shows that its omission does not affect the results for the other independent variables (see Appendix 3.A). The proportion of graduates with work experience relevant to their career is about 46% (college) and 43% (university).

Table 3.3: sample means for independent variables, college graduates. Source: Statistics Netherlands, ROA-SIS 1997 – 2008, own computations.

Variable	Mean or % share	Std. Dev.	Min	Max
Demographics				
Male	0.41		0	1
Foreign	0.06		0	1
Age	24.52	1.74	20	30
Field of study				
Agriculture	0.05		0	1
Teaching	0.12		0	1
Engineering	0.20		0	1
Economics	0.32		0	1
Health	0.12		0	1
Behavioural Sciences (ref)	0.15		0	1
Humanities	0.03		0	1
Study: background information				
Completed Internship	0.98		0	1
Relevant Work Experience	0.46		0	1
In Further Education	0.16		0	1
Completed Further Education	0.03		0	1
Study Duration	47.58	11.05	3	120
Months Graduation to Questionnaire	17.52	3.10	2	52
Regional and National Economic Characteristics				
Number of Higher or Scientific jobs	0.253	0.132	0.026	0.484
Relative Cost of Living	0.007	0.136	-0.340	0.250
Relative Regional GDP Growth rate	0.000	0.013	-0.059	0.059
Unemployment rate college graduates	0.044	0.014	0.010	0.100
National GDP growth rate	0.029	0.014	0.001	0.047
N total	120624			

We include two dummy variables to indicate whether a graduate was participating in further education at the time of interview, or whether such education had already been completed. As one might expect, only a very small percentage of interviewees indicated that, only 18 months after completion of their primary studies, they had already completed further education (3% of college graduates, 5% of

university graduates). The salient reference category for the further education dummies is thus ‘no further education’.

We also controlled for study duration. The college graduates took a little over 47 months on average to complete their programmes, whereas university graduates took a little over 62 months on average, but there is considerable spread in the data. Most Dutch college programmes take four years to complete, although some are a little shorter. Technical programmes at the university level take a nominal 60 months and end with the award of a master degree. Next, we controlled for the window of observation: graduates were, on average, observed 18 months after graduation, but there is a spread of some months. Graduates who were questioned after longer intervals exhibited significantly higher mobility rates.

Table 3.4: sample means for independent variables, university graduates. Source: Statistics Netherlands, ROA-SIS 1998 – 2007, own computations.

Variable	Mean or % share	Std. Dev.	Min	Max
Demographics				
Male	0.47		0	1
Age	26.13	1.67	20	30
Field of study				
Agriculture	0.04		0	1
Engineering	0.17		0	1
Economics	0.17		0	1
Health	0.12		0	1
Behavioural Sciences (ref)	0.21		0	1
Humanities	0.10		0	1
Law	0.11		0	1
Natural Sciences	0.08		0	1
Study: background information				
Relevant Work Experience	0.43		0	1
In Further Education	0.21		0	1
Completed Further Education	0.05		0	1
Study Duration	62.24	20.89	1	298
Months Graduation to Questionnaire	18.30	3.86	1	63
Regional and National Economic Characteristics				
Number of Higher or Scientific jobs	0.275	0.136	0.052	0.479
Relative Cost of Living	0.006	0.144	-0.340	0.250
Relative Regional GDP Growth rate	-0.001	0.014	-0.058	0.034
Unemployment rate college graduates	0.034	0.012	0.000	0.060
National GDP growth rate	0.026	0.015	0.001	0.047
N total	63474			

3.3.3.3 Regional characteristics

Tables 3.3 and 3.4 continue with the mean values for the regional economic characteristics, the key variables in this analysis. We see the variables as measuring prevailing conditions in the source NUTS 2 study regions. Theoretically, they are expected to act as either pure ‘push’ or pure ‘keep’ factors. We distinguish between structural effects and cyclical effects. Unless stated otherwise, the regional economic data were obtained through Statistics Netherlands, the governmental statistical service.

All economic indicators are entered with a one year lag, so as to more closely reflect the situation at the time of graduation rather than the time of interview.

Firstly, we enter the number of workers in higher and scientific jobs in the region's active labour force. This variable reflects the number of job opportunities in the study region, and it is expected that graduates are pulled towards regions with large labour markets. This variable is entered to control for this structural process.

Secondly, we enter the region's relative cost of living. The variable (COL) is operationalised by taking the average value, on the NUTS 2 level, of family homes as a percentage of the national average. If $P_{i,t}$ is the average house price in region i at time t , then

$$COL_{i,t} = (P_{i,t} - P_{NL,t}) / P_{NL,t}$$

The result is a variable with mean annual values close to 0. Positive values indicate that house prices in the study region are relatively high.

Thirdly, the regional economic growth rate (based on regional GDP) is entered, again relative to the national growth rate. This results in an indicator with a zero average value, and positive values for regions with relatively favourable developments. If $R_{i,t}$ is the rate of growth in a region's GDP, and $R_{NL,t}$ the rate of growth in national GDP at time t :

$$REGG_{i,t} = R_{i,t} - R_{NL,t}$$

This variable (REGG) is intended to pick up cyclical effects at the regional level that differ from what is happening nationally.

Fourth, the regional unemployment rate, $U_{i,t}$, is entered as a measure of structural differences in employment opportunities across regions. Calculated using the ROA-SIS dataset, it is computed as the percentage of college or university graduates participating in the labour force but looking for work (i.e. actively seeking work). In peripheral areas, unemployment rates are generally higher. During the recession covered, these areas also suffered the sharpest increases in unemployment rates (Allen *et al.*, 2009). The unemployment rates among college graduates are, on average, slightly higher than those found for university graduates (4.4% versus 3.4%).

Fifth, we enter the national economic growth rate (GDP), $R_{NL,t}$, as an indicator of position in the business cycle.

Our sixth entry, and our final aspect, is a linear trend variable. This variable is intended to pick up any remaining trends in the dependent variable that are not covered by the other explanatory variables.

3.4 Multivariate analysis

3.4.1 Method

In this section, we present our multivariate analysis of graduate migration. The dependent variable is the four-way measure of the degree of mobility presented earlier. We estimate a multinomial logit model, including the explanatory variables presented in Section 3.3. The results are presented in Tables 3.5 (college graduates) and 3.6 (university graduates). The reference category in the multinomial logit models is ‘Remaining in the NUTS 2 study region’, with the three other option categories reflecting varying degrees of spatial mobility relative to this ‘stay-put’ option. All the continuous variables (i.e. age, study duration, and time between graduation and questionnaire), and all the regional and other economic variables were entered as z-scores, that is they were standardised to have a mean of zero and a unity standard deviation. This makes it easier to judge the relative effect strengths by comparing model coefficients with different options within a model.

Further, coefficients in multinomial logit models are defined only up to a level and hence cannot be directly compared between models. Moreover, as opposed to the dummy variables, it is not intuitively straightforward, using the coefficients, to judge the effect of continuous covariates on the various probabilities. Therefore, the results of the estimation were used to compute the probability of moving for a reference group of graduates (here, females who studied economics, completed an internship and not in further education), with all the continuous variables given the standardised mean of zero. We then computed, for this reference group, the effect size, for each of the regional economic variables, on the probabilities of either staying or moving, all other things being equal. The effect sizes reflect the percentage points change in probability of selecting an option, relative to the mean, when letting a specific variable run from its lowest to its highest observed value. Alternatively, the effect sizes can be studied by looking at the effect of a one unit change, in this case the equivalent one standard deviation change, in the variable, or by computing the relevant marginal effects. Choosing this option would not substantially change our analysis or the conclusions. We selected the approach we did based on its ease of interpretation. Compared to model coefficients, these effect sizes give a more readily interpretable indication of the economic significance of individual results. Further, they allow us to directly compare the results of college and university graduates. In Tables 3.5 and 3.6, we only show the effect sizes for the variables that are of major interest in this study. The effect sizes for these two models are reported for all variables in Appendix 3.B.

Table 3.5: Estimation results, MNL models, college graduates

Multinomial Logit	College 1997 - 2008			
	Stay in NUTS 2 (reference)	Move Within NUTS 1	Move Between NUTS 1	Move Abroad
Demographic controls				
Male		-0.01	-0.16 ***	0.01
Foreign		0.00	-0.13 ***	0.25 ***
Age		0.18	0.09	1.56 ***
Age Squared		-0.11	-0.02	-1.34 ***
Field of Study				
Agriculture		0.63 ***	1.43 ***	1.88 ***
Teaching		0.12 ***	0.06 **	-0.19
Engineering		0.33 ***	0.60 ***	1.22 ***
Economics		0.20 ***	0.60 ***	1.48 ***
Health		0.22 ***	0.37 ***	1.81 ***
Humanities		0.60 ***	0.50 ***	1.93 ***
Study: other controls				
Completed Internship		0.18 ***	0.11 **	-0.08
Relevant Work Experience		0.05 ***	0.07 ***	0.31 ***
In Further Education		-0.19 ***	-0.12 ***	-0.75 ***
Completed Further Education		-0.08 *	-0.03	0.35 ***
Study Duration		-0.01	-0.07 ***	-0.15 ***
Months Graduation to Questionnaire		0.03 ***	0.03 ***	0.06 ***
Regional economic controls				
Number of Higher or Scientific jobs		-0.42 ***	-0.67 ***	-0.39 ***
Relative Cost of Living		0.03 ***	0.18 ***	0.09 ***
Relative Regional GDP growth rate		0.00	-0.04 ***	-0.03 *
Unemployment rate c or u graduates		-0.02 **	0.06 ***	0.08 ***
Trend		0.04 ***	0.03 ***	0.00
National GDP growth rate		0.00	0.03 ***	0.02
Intercept		-1.60 ***	-1.46 ***	-4.33 ***
N				120624
Pseudo R ²				0.05
LR chi2(66)				12732.49
Prob > chi2				0.00
Predicted probabilities	54.9%	16.3%	25.9%	2.9%
Effect size as variable moves from Min to Max value				
Number of Higher or Scientific jobs	44.8%	-8.2%	-35.4%	-1.2%
Relative Cost of Living	-12.7%	-1.6%	13.8%	0.4%
Relative Regional GDP growth rate	5.1%	1.5%	-6.0%	-0.6%
Unemployment rate c or u graduates	-5.3%	-3.8%	7.7%	1.3%
Trend	-2.4%	1.5%	1.0%	-0.1%
National GDP growth rate	-1.6%	-0.5%	2.0%	0.1%

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

3.4.2 Results for control variables

Before turning to the variables that are the main focus of this chapter, we briefly discuss the other control variables. The results for the demographic controls are somewhat mixed. Male college graduates are less likely to move between NUTS 1 regions, and male university graduates are also more likely to move abroad than females. The relationship with age is generally shaped like an inverse U. For college graduates we were able to include a dummy indicating whether they were ‘foreign’ or

not, with foreigners less likely to move between NUTS 1 regions, and more likely to move abroad.

Table 3.6: Estimation results, MNL models, university graduates.

Multinomial Logit	University 1998 - 2007 <i>Excl foreign and internships</i>			
	Stay in NUTS 2 (reference)	Move Within NUTS 1	Move Between NUTS 1	Move Abroad
Demographic controls				
Male		-0.02	-0.02	0.22***
Age		0.86***	1.72***	0.87
Age Squared		-0.76***	-1.64***	-0.82
Field of Study				
Agriculture		-0.88***	1.12***	1.75***
Engineering		0.11***	0.58***	1.31***
Economics		0.11***	0.55***	0.91***
Health		0.01	0.12***	0.11
Humanities		-0.09**	-0.11***	0.77***
Law		0.16***	0.06*	0.01
Natural Sciences		0.30***	-0.07	0.77***
Study: other controls				
Relevant Workexp		0.05**	-0.03	0.13***
In Further Education		-0.58***	-0.51***	-0.07
Completed Further Education		-0.02	0.02	0.63***
Study Duration		-0.06***	-0.11***	-0.04*
Months Graduation to Questionnaire		0.01	0.03***	0.05**
Regional economic controls				
Number of Higher or Scientific jobs		-0.11***	-0.95***	-0.35***
Relative Cost of Living		0.08***	0.00	-0.11***
Relative Regional GDP growth rate		0.00	-0.08***	-0.09***
Unemployment rate c or u graduates		0.09***	-0.10***	-0.03
Trend		0.02	0.00	0.26***
National GDP growth rate		0.09***	0.00	0.07***
Intercept		-0.75***	-0.67***	-3.25***
N				63474
Pseudo R ²				0.09
LR chi2(66)				12989.91
Prob > chi2				0.00
Predicted probabilities	39.8%	20.9%	35.4%	3.8%
Effect size as variable moves from Min to Max				
Number of Higher or Scientific jobs	41.5%	15.6%	-57.6%	0.5%
Relative Cost of Living	-2.1%	6.0%	-1.8%	-2.1%
Relative Regional GDP growth rate	8.4%	4.8%	-11.7%	-1.5%
Unemployment rate c or u graduates	3.9%	11.9%	-15.6%	-0.2%
Trend	-1.8%	0.3%	-1.5%	3.0%
National GDP growth rate	-2.6%	4.2%	-2.2%	0.6%

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

Generally, the results indicate that graduates from all the other fields considered are significantly more mobile than the reference category of ‘Behavioural and Social Sciences’, although there are some deviations from this pattern, such as the ‘Teaching’ category among college graduates and ‘Healthcare’ and ‘Humanities’

among the university graduates. Law and Natural Sciences are not taught at college level. Conversely, there were too few observations related to ‘Teaching’ at the university level, and so this was combined with the reference category. Having completed an internship or having relevant work experience generally serves to increase the likelihood of a move. Unfortunately, we did not have any information on the location of these internships, but we would expect the majority to take place within a reasonable distance of the institution of higher education. Our results seem to indicate that these (sometimes extra-curricular) activities do not necessarily help to retain graduates in their study region and may even have the opposite effect. Perhaps, internships and work experience ease spatial mobility through an increase in levels of human capital. Conversely, actively participating in further education reduces spatial mobility among both college and university graduates. However, completing such education increases the likelihood of a move abroad. With this further education often taking place at an institution in the original study region, the presence of such opportunities increases retention rates, at least in the short term.

Graduates that have taken a relatively long time to complete their studies are also more likely to stay in the area, and are particularly unlikely to move to a different NUTS 1 region or abroad. Graduates that were interviewed relatively late have a higher probability of spatial mobility.

Generally, these results are in line with our expectations as well as the findings in Venhorst *et al.* (2010), even though that study was restricted to the mobility of graduates from the more peripheral NUTS 1 regions of the Netherlands. They are also in line with earlier findings for the UK (Faggian *et al.*, 2007a, 2007b).

3.4.3 Results for economic variables

We now turn to a discussion on the key regional economic variables in our analysis. Firstly, there is a negative relationship between the number of higher and scientific level jobs in the study region and the probability of moving. Graduating in a NUTS 2 region with a large labour market is linked to a substantially lower probability of outmigration. From both the z-standardised coefficients in our models, as well as the full effect size Table 3.B.1 (Appendix 3.B), it is clear that this is the most substantial effect among our economic variables. For our reference group of female economics graduates, the probability of staying in the NUTS 2 study region increases by 44.8 percentage points for college graduates as we move from low to high numbers of jobs along the spectrum of Dutch NUTS 2 regions. Put differently, the probability of staying for this group lies roughly between 32.5% ($((54.9\% - (44.8\% / 2))$) in regions with a small labour market, and 77.3% ($((54.9\% + (44.8\% / 2))$) in those regions with the largest labour markets. Among university graduates, this spread is only slightly

narrower at 41.5 percentage points. In contrast to college graduates, the likelihood that a university graduate moves within a NUTS 1 region increases (15.6 percentage points difference between the smallest and largest labour markets) with the strength of the labour market. This result is indicative of the non-linearities that are inherent to the multinomial model. Although we end up with a negative coefficient, relative to the reference option, for moving *within* the NUTS 1 region, the reduction in the likelihood of moving *beyond* the NUTS 1 region dominates this effect, resulting in job numbers having a marginal but positive effect on the likelihood of moving within the NUTS 1 region, all other things being equal. We will return to this rather surprising result in our discussion. The likelihood of moving to a new NUTS 1 region is lower for graduates from those study regions with large labour markets than in those with fewer opportunities, again by a quite substantial margin.

We found that a relatively high cost of living, as measured by the average value of housing in the study region, serves to increase the probability of outmigration by college graduates. The relationship is less clear for university graduates. A high cost of living does increase the likelihood of moving to a neighbouring NUTS 2 region, but not further afield to another NUTS 1 region, for the latter group. University graduates from relatively expensive study regions are less likely to move abroad. In terms of effect sizes, for college graduates the probability of staying decreases 12.7 percentage points when comparing the most inexpensive to the most expensive region. Outmigration as a result of high costs is almost all towards other NUTS 1 regions. With university graduates, the main effect is found to be a lot smaller, and focussed more on relatively short distance moves to another NUTS 2 region within the same NUTS 1 area. In general, university graduates earn more than their college counterparts and, maybe, the smaller effect sizes for the former indicate that the cost of living is less critical in location decisions. The effect that was found related to shorter distance moves. Overall, the results indicate that graduates move away from expensive, or high in demand, regions, rather than towards them. This does not lend support to arguments for an amenity-driven migration flow for this particular group.

Having a relatively high regional GDP growth rate reduces the probability of a move beyond the NUTS 1 region, or a move abroad, for both college and university graduates. In contrast to the cost of living measure, in terms of effect sizes, this factor appears to be relatively more important for the university graduates, with the reduction in the likelihood of leaving the NUTS 1 region almost double that of college graduates: a reduction of 11.7 percentage points versus 6.0 percentage points. Again the neighbouring NUTS 2 regions seem to benefit somewhat, in terms of an inflow of university graduates, from relatively high regional economic growth rates in a graduate's study region.

The results when considering unemployment rates among recent graduates are mixed. In terms of the model coefficients, for college graduates, high unemployment rates reduce the probability of a move to a neighbouring NUTS 2 region, but increase the likelihood of a move to a different NUTS 1 region or abroad. For university graduates, we find a more-or-less reversed pattern. This is especially apparent when looking at the effect sizes. Moving from the lowest to the highest unemployment rates sees the likelihoods of staying put or moving to a neighbouring NUTS 2 region reducing by 5.3 and 3.8 percentage points respectively for college graduates, whereas we find increases of 3.9 and 11.9 percentage points respectively for university graduates. For college graduates, the dominant effect of local unemployment appears to be to leave the NUTS 2 study region and, since moving costs will be incurred, to move lengthy distances. For the university graduates, the dominant response is to move shorter distances, to a neighbouring NUTS 2 region or, to a lesser extent, to stay despite the high unemployment rates. This perhaps reflects the broader range of possibilities, in addition to spatial mobility, open to university graduates in dealing with the risk of unemployment. One such option would be to accept work at a lower (i.e. college graduate) level. Such competition may also be at the root of the higher outmigration effect we found for college graduates.

Despite our various controls, we still have significant trends remaining in terms of Dutch graduate migration. The signs however are surprising to some extent, given the arguments presented in Section 3.2. For college graduates, we find a persistent positive trend in the probability of moving to either a neighbouring NUTS 2 region, or to a different NUTS 1 region, as opposed to staying within the NUTS 2 study region. For university graduates, we find a relatively strong positive trend in the probability of moving abroad. In terms of absolute effect size, we must admit that these trends are of limited magnitude. Nevertheless, there are some interesting implications. First, the sample statistics presented in Section 3.3 indicate a positive trend in the likelihood of college graduates staying in their NUTS 2 study region. However, after correcting for both economic factors as well as characteristics on the level of individual graduates, this is reversed into a modest negative effect of 2.4 percentage points over the time span of the study. We also find a rather similar 1.8 percentage point reduction for the university graduates. A second interesting finding is the 3.0 percentage points increase in the probability of university graduates moving abroad. Compared to the baseline probability of 3.8% for our reference group, this is a substantial effect, and one which has not been explained by the other independent variables in our model. Arguably, the missing indicator in the university model of ‘being foreign’ could play a role here, even though comparative analysis for the college graduates did not reveal a substantial relationship between this and the trend parameter. Further, even though the enrolment

of foreign students in Dutch universities has increased substantially over the last decade, the full effect of this will not have been captured by our data since many of these students are only just starting to complete their programmes. As such, the cause of this positive trend with university graduates is largely unexplained and would make an interesting topic for further research, for example in considering the effects of internationalisation programmes and travel scholarships on universities.

Finally, the effects of up- or down- swings in the business cycle, as measured by the national GDP growth rate, also appear to be relatively modest. This is in line with earlier studies. For college graduates, the likelihood of moving to a different NUTS 1 region increases with an upswing in the business cycle by 2.0 percentage points. In contrast, the equivalent probability decreases by a similar amount for university graduates. Interestingly, for the latter group, moving to an adjacent NUTS 2 region seems to be a relatively favourable option in an economic upswing. As the probability of staying decreases for both groups, it can cautiously be concluded that spatial mobility is generally encouraged by economically favourable circumstances, a finding in contrast with the search effort hypothesis.

3.5 Discussion

In this section we return to two separate issues that transpired from our results as presented in Section 3.4. These are, firstly, the relative importance of the various sets of explanatory variables in our models and, secondly, the surprising signs found for some of our economic push and keep factors.

As opposed to the initially negative trends in graduate mobility observed in Section 3.3, we find either an insignificant or a positive trend after controlling for individual and regional economic characteristics. We ran a stepwise analysis, adding groups of control variables to a baseline model that only featured the trend and business cycle variables, to investigate whether the changes observed in Section 3.2 could be explained by composition effects in our sample (i.e. due to characteristics of the individuals involved) or by economic variables. The results are reported in detail in Appendix 3.C. Essentially, after entering the regional economic characteristics, these variables became insignificant in their influence, or even changed sign from the simpler analysis. From this, it can be concluded that regions that are doing relatively well economically are more likely to retain local graduates.

Then regarding some of the surprising effect signs of our economic explanatory variables: in some instances, our economic ‘push’ or ‘keep’ factors influence the decision to stay and the decision to move the relatively short distances within a NUTS

1 region similarly. If we interpret these findings in terms of pure ‘keep’ or ‘push’ factors we arrive at hypotheses that require these effects to have opposite signs. This however is only found for job numbers (and only for college graduates), cost of living and national growth rate (university graduates only), and the trend indicator (both groups). These findings can be interpreted in two ways. Firstly, this result could be indicative of spatial spillover effects, with graduates’ evaluations of the economic circumstances in their study regions affecting the attractiveness of nearby NUTS 2 regions, perhaps for example with an eye to future return migration. A second interpretation is that NUTS 2 regions which share certain economic characteristics are co-located within the same NUTS 1 region. We ran Wald tests on both models to ascertain whether our model categories are sufficiently different, and this was confirmed. Studying the effect of there being greater economic opportunities in neighbouring regions, as well as the influence of possible future return migration, is a promising avenue for future research. In general, however, our findings indicate that regional economic circumstances can only be interpreted as clear ‘keep’ or ‘push’ factors when long distance migration is considered.

3.6 Conclusions

From this analysis a number of insights emerge. Firstly, graduate migration in the Netherlands is primarily dependent on the spatial distribution of suitable jobs and, as such, should be regarded as structural in nature. Graduates are pulled towards areas where there are more jobs. For college graduates, the second most important factor is regional differences in costs of living, which again can be regarded as structural. For university graduates, cyclical elements such as regional economic growth and unemployment rates play a stronger role. The positive trend in spatial mobility, albeit of modest proportions in an absolute sense, is all the more interesting given this largely structural backdrop.

A second, somewhat more surprising, result is the relatively strong role that most of the considered economic characteristics in our model play in a decision to move within the NUTS 1 study region for university graduates compared to college graduates. The sample statistics presented in Section 3.3 show that such a move is, in general, more frequent among college graduates. Only for the NUTS 1 West region did we find a substantially higher proportion of university graduates on the move (Tables 3.1 and 3.2). Based on these findings, it would appear that for those university graduates who do move within their NUTS 1 region, this decision is strongly determined by economic circumstances. Conversely, for college graduates this is not a strong factor in the decision.

From a policy perspective, a key result in this analysis is the importance of what can be interpreted as an opportunity-rich labour market in attracting or retaining recent graduates. This could be viewed as an aspect that is hard for local policymakers to influence given the large structural flows of graduates towards the economic centre of the Netherlands. Nevertheless, we have shown that graduates are becoming less migratory, and that this can be explained by economic developments in the various regions: graduates are retained as regions do better. Local policymakers are trying to improve the supply of suitable housing, or enhance living surroundings in general, but, in the highly institutionalised Dutch context, this is sometimes difficult to achieve. Overall, the cost of housing is only a weak influence on migration, especially of university graduates, although there is a tendency for graduates to move out of expensive regions. It is, however, the second most important factor when it comes to college graduates who migrate longer distances. On the other hand, university graduates appear to be more sensitive to cyclical aspects of the regional economy, such as the unemployment and growth rates. However, higher unemployment does not necessarily cause outmigration among university graduates. One idea is that this is due to their greater flexibility in finding work, given their higher levels of human capital, and that this allows these graduates to be somewhat more risk-taking in their location decisions. Their stronger response to the national business cycle is also indicative of this. These are important factors to take into account when considering policies aimed at attracting or retaining graduates.

References

- Allen, J., G. v. Breugel, J. Coenen, D. Fouarge, C. Meng, G. Ramaekers, J. van Dijk and V.A. Venhorst (2009) *Afgestudeerden van het hbo tijdens een crisis: geen verloren generatie*. HBO-raad, Den Haag.
- Antolin, P. and O. Bover (1997) Regional migration in Spain: the effect of personal characteristics and of unemployment, wage and house price differentials using pooled cross-sections. *Oxford Bulletin of Economics and Statistics*, 59(2), 215-235.
- Bartel, A. P. (1979) The migration decision: what role does job mobility play? *The American Economic Review*, 69(5), 775-786.
- Blanchard, O. J. and L. F. Katz (1992) Regional Evolutions, *Brookings Papers on Economic Activity*, 1992(1), 1-75.
- Broersma, L. and J. van Dijk (2002) Regional labour market dynamics in the Netherlands. *Papers in Regional Science* 81(3), 343-364.
- Büchel, F. and M. van Ham (2003) Overeducation, regional labor markets, and spatial flexibility. *Journal of Urban Economics*, 53(3), 482-493.
- Clark, D. E. and J. C. Cosgrove (1991) Amenities versus labor market opportunities: choosing the optimal distance to move. *Journal of Regional Science*, 31(3), 311-328.

- Coniglio, N. D. and F. Prota (2008) Human capital accumulation and migration in a peripheral EU region; the case of Basilicata, *Papers in Regional Science*, 87(1), 77-96.
- Cörvers, F., M. M. Hensen and D. Bongaerts (2009) Delimitation and coherence of functional and administrative regions. *Regional Studies*, 43(1), 19-31.
- Coulombe, S. (2006) Internal migration, asymmetric shocks, and interprovincial economic adjustments in Canada. *International Regional Science Review*, 29(2), 199-223.
- Decressin, J. and A. Fatás (1995) Regional labor market dynamics in Europe. *European Economic Review*, 39(9), 1627-1655.
- Détang-Dessendre, C. (1999) Reciprocal link between exit from unemployment and geographical mobility, *Environment and Planning A*, 31(8), 1417-1431.
- Détang-Dessendre, C., C. Drapier and H. Jayet (2004) The impact of migration on wages: empirical evidence from French youth. *Journal of Regional Science*, 44(4), 661-691.
- Faggian, A. and P. McCann (2006) Human capital flows and regional knowledge assets: a simultaneous equation approach. *Oxford Economic Papers*, 58(3), 475-500.
- Faggian, A., P. McCann and S. Sheppard (2006) An analysis of ethnic differences in UK graduate migration behaviour. *The Annals of Regional Science*, 40(2), 461-471.
- Faggian, A., P. McCann and S. Sheppard (2007a) Human capital, higher education and graduate migration: an analysis of Scottish and Welsh students. *Urban Studies*, 44(13), 1-18.
- Faggian, A., P. McCann and S. Sheppard (2007b) Some Evidence that women are more mobile than men: gender differences in UK graduate migration behavior. *Journal of Regional Science*, 47(3), 517-539.
- Fielding, A. J. (1992) Migration and social mobility: south east England as an escalator region. *Regional Studies*, 26(1), 1-15.
- Glaeser, E. L. and P. D. Gottlieb (2006) Urban Resurgence and the Consumer City. *Urban Studies*, 43(8), 1275-1299.
- Glaeser, E. L. and A. Saiz (2004) The rise of the skilled city. *Brookings-Wharton Papers on Urban Affairs*, 47-105.
- Gottlieb, P. D. and G. Joseph (2006) College to work migration of technology graduates and holders of doctorates within the United States. *Journal of Regional Science*, 46(4), 627-659.
- Greenwood, M. J. (1975) Research on internal migration in the United States: a survey. *Journal of Economic Literature*, 13(2), 397-433.
- Graves, P. E. and P. Linneman (1979) Household migration: theoretical and empirical Results. *Journal of Urban Economics*, 6(3), 383-404.
- Haapanen, M. and H. Tervo (2009) Return and onward migration of highly educated: evidence from residence spells of Finnish graduates. *School of Business and Economics, University of Jyväskylä*.
- van Ham, M., C. H. Mulder and P. Hooimeijer (2001) Local underemployment and the discouraged worker effect. *Urban Studies*, 38(10), 1733-1751.
- Hansen, S. B., C. Ban and L. Huggins (2003) Explaining the 'brain drain' from older industrial cities: the Pittsburgh region. *Economic Development Quarterly*, 17(2), 132-147.
- Helderman, A., M. van Ham and C. H. Mulder (2006) Migration and home ownership. *Tijdschrift voor Economische en Sociale Geografie*, 97(2), 111-125.

- Hensen, M. M., R. M. De Vries and F. Cörvers (2009) The role of geographic mobility in reducing education-job mismatches in the Netherlands. *Papers in Regional Science*, 88(3), 667-683.
- Hunt, G. L. (1993) Equilibrium and disequilibrium in migration modelling. *Regional Studies*, 27(4), 341-349.
- Lucas, R. E. (1988) On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3-42.
- Partridge, M. (2010) The duelling models: NEG vs amenity migration in explaining US engines of growth. *Papers in Regional Science*, 89(3), 513-536.
- Pekkala, S. and H. Tervo (2002) Unemployment and migration: does moving help? *Scandinavian Journal of Economics*, 104(4), 621-639.
- Plane, D. (1993) Demographic influences on migration. *Regional Studies*, 27(4), 375-383.
- Romer, P. M. (1986) Increasing returns and long-run growth. *The Journal of Political Economy*, 94(5), 1002-1037.
- Sjaastad, L. A. (1962) The costs and returns of human migration. *The Journal of Political Economy*, 70(5, Part 2: Investment in human beings), 80-93.
- Storper, M. and A. J. Scott (2009) Rethinking human capital, creativity and urban growth. *Journal of Economic Geography*, 9(2), 147-167.
- Van der Gaag, N. and L. J. G. van Wissen (2008) Economic determinants of internal migration rates: a comparison across five European countries. *Tijdschrift voor Economische en Sociale Geografie*, 99(2), 209-222.
- Venhorst, V. A. and F. Cörvers (2010) Entry into the working life: spatial mobility and job-match quality of higher educated graduates. *Conference of the North American Regional Science Council*, Denver, Colorado, United States.
- Venhorst, V. A., J. van Dijk and L. J. G. van Wissen (2010) Do the best graduates leave the peripheral areas of the Netherlands? *Tijdschrift voor Economische en Sociale Geografie*, 101(5), , 521-537.
- Whisler, R. L., B. S. Waldorf, G. F. Mulligan and D. Plane (2008) Quality of life and the migration of the college-educated: a life-course approach. *Growth and Change*, 39(1), 58-94.

Appendix 3.A: sensitivity analysis with respect to omitted variables and years

Table 3.A.1: Estimation results, MNL models, college graduates, differing specifications.

Multinomial Logit	College 1997 - 2008 <i>Excl foreign and internships</i>			College 1998 - 2007 <i>Excl foreign and internships</i>		
	Move Within NUTS 1	Move Abroad	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Move Abroad
Reference: Stay in Study region						
Demographic controls						
Male	-0.01	0.00	-0.16 ***	-0.01	-0.16 ***	-0.02
Age	0.19	1.53 ***	0.10	0.13	0.05	1.35 ***
Age Squared	-0.12	-1.30 ***	-0.03	-0.07	0.02	-1.12 **
Field of Study						
Agriculture	0.63 ***	1.87 ***	1.44 ***	0.58 ***	1.45 ***	1.79 ***
Teaching	0.12 ***	-0.20	0.06 **	0.09 ***	0.09 ***	-0.23 *
Engineering	0.33 ***	1.22 ***	0.60 ***	0.33 ***	0.60 ***	1.13 ***
Economics	0.20 ***	1.48 ***	0.60 ***	0.20 ***	0.61 ***	1.41 ***
Health	0.22 ***	1.80 ***	0.38 ***	0.21 ***	0.38 ***	1.64 ***
Humanities	0.56 ***	1.94 ***	0.49 ***	0.59 ***	0.48 ***	1.97 ***
Study: other controls						
Relevant Work Experience	0.05 ***	0.31 ***	0.07 ***	0.05 ***	0.06 ***	0.30 ***
In Further Education	-0.19 ***	-0.74 ***	-0.12 ***	-0.20 ***	-0.13 ***	-0.82 ***
Completed Further Education	-0.07	0.35 ***	-0.03	-0.04	-0.03	0.47 ***
Study Duration	-0.01	-0.15 ***	-0.06 ***	-0.01	-0.06 ***	-0.15 ***
Months Graduation to Questionnaire	0.03 ***	0.06 ***	0.03 ***	0.04 ***	0.03 ***	0.06 ***
Regional economic controls						
Number of Higher or Scientific jobs	-0.42 ***	-0.38 ***	-0.67 ***	-0.44 ***	-0.68 ***	-0.36 ***
Relative Cost of Living	0.03 ***	0.09 ***	0.18 ***	0.03 ***	0.18 ***	0.07 ***
Relative Regional GDP Growth rate	0.00	-0.03 *	-0.04 ***	0.01	-0.04 ***	0.00
Unemployment rate college grads	-0.02 **	0.08 ***	0.06 ***	-0.04 ***	0.04 ***	0.06 ***
Trend	0.04 ***	0.01	0.02 ***	0.05 ***	0.02	0.07 ***
National GDP growth rate	0.00	0.02	0.03 ***	0.00	0.04 ***	0.03 ***
Intercept	-1.42 ***	-4.39 ***	-1.36 ***	-1.41 ***	-1.36 ***	-4.33 ***
N	120624			99045		

Pseudo R²
 LR chi2(66)
 Prob > chi2
 *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

0.05
 12687.01
 0.00

0.05
 10400.66
 0.00

In Table 3.A.1, the estimation results are presented for two alternative specifications of the model in Table 3.5 (college graduates). Both model specifications exclude the dummies for ‘foreign’ and ‘completed internship’, whereas the right hand columns also feature the results for a reduced time period. In Table 3.A.2 we compare the effect sizes with those reported for the model in Table 3.5 and the differences are minimal.

Table 3.A.2: Effect size as variables move from minimum to maximum values.

Multinomial Logit	College (model Table 3.5)				College				College			
	1997 - 2008				1997 – 2008				1998 - 2007			
	Stay in NUTS 2 (reference)	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Stay in NUTS 2 (reference)	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Stay in NUTS 2 (reference)	Move Within NUTS 1	Move Between NUTS 1	Move Abroad
Predicted probabilities	54.9%	16.3%	25.9%	2.9%	55.0%	16.3%	25.7%	3.0%	54.9%	16.3%	25.8%	3.0%
Effect size as variable moves from Min to Max value												
Number of Higher or Scientific jobs	44.8%	-8.2%	-35.4%	-1.2%	44.8%	-8.2%	-35.4%	-1.2%	45.1%	-8.8%	-35.5%	-0.9%
Relative Cost of Living	-12.7%	-1.6%	13.8%	0.4%	-12.6%	-1.6%	13.8%	0.4%	-12.2%	-1.6%	13.6%	0.2%
Relative Regional GDP growth rate	5.1%	1.5%	-6.0%	-0.6%	5.1%	1.5%	-6.0%	-0.6%	3.6%	3.1%	-6.9%	0.3%
Unemployment rate college grads	-5.3%	-3.8%	7.7%	1.3%	-5.3%	-3.8%	7.7%	1.4%	-1.7%	-4.5%	5.1%	1.1%
Trend	-2.4%	1.5%	1.0%	-0.1%	-2.4%	1.6%	0.8%	0.0%	-2.5%	1.8%	0.1%	0.6%
National GDP growth rate	-1.6%	-0.5%	2.0%	0.1%	-1.6%	-0.5%	2.0%	0.1%	-1.9%	-0.4%	2.0%	0.3%

Appendix 3.B: effect sizes all variables

Table 3.B.1: Effect size as variable moves from minimum to maximum value, main models, all variables.

Multinomial Logit	College (model Table 3.5) 1997 – 2008				University (model Table 3.6) 1998 – 2007			
	Stay in NUTS 2 (reference)	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Stay in NUTS 2 (reference)	Move Within NUTS 1	Move Between NUTS 1	Move Abroad
Predicted Probabilities	54.9%	16.3%	25.9%	2.9%	39.8%	20.9%	35.4%	3.8%
Effect size as variable moves from Min to Max value								
Male	2.2%	0.6%	-2.9%	0.1%	0.1%	-0.3%	-0.7%	1.0%
Foreign	1.3%	0.5%	-2.6%	0.9%				
Age	-53.6%	-6.4%	-17.4%	77.4%	-95.5%	5.1%	89.4%	1.0%
Age Squared	28.1%	0.2%	11.3%	-39.7%	89.5%	4.1%	-94.0%	0.5%
Agriculture	-29.2%	-1.9%	25.0%	6.1%	-17.6%	-16.1%	25.2%	8.5%
Teaching	-1.7%	1.5%	0.8%	-0.6%				
Engineering	-14.2%	0.6%	9.2%	4.4%	-11.5%	-4.3%	9.6%	6.2%
Economics	-11.1%	0.2%	8.8%	2.1%	-9.6%	-2.4%	10.1%	1.9%
Health	-12.9%	-0.8%	2.9%	10.8%	-1.9%	-0.8%	2.5%	0.3%
Humanities	-17.7%	3.8%	3.2%	10.8%	0.4%	-1.6%	-3.4%	4.6%
Law					-2.3%	2.3%	0.2%	-0.2%
Natural Sciences					-3.3%	4.9%	-5.3%	3.7%
Completed Internship	-3.0%	2.0%	1.4%	-0.4%				
Relevant Work Experience	-2.0%	0.3%	0.8%	0.9%	-0.2%	0.9%	-1.2%	0.5%
In Further Education	4.3%	-1.7%	-1.2%	-1.4%	12.3%	-5.6%	-7.6%	0.9%
Completed Further Education	0.4%	-1.1%	-0.6%	1.3%	-1.3%	-1.1%	-0.6%	3.1%
Study Duration	12.9%	1.9%	-11.4%	-3.5%	28.5%	-4.0%	-24.9%	0.4%
Months Graduation to Questionnaire	-13.8%	4.3%	6.9%	2.6%	-10.1%	-1.1%	9.3%	1.9%
Number of Higher or Scientific jobs	44.8%	-8.2%	-35.4%	-1.2%	41.5%	15.6%	-57.6%	0.5%
Relative Cost of Living	-12.7%	-1.6%	13.8%	0.4%	-2.1%	6.0%	-1.8%	-2.1%
Relative Regional GDP growth rate	5.1%	1.5%	-6.0%	-0.6%	8.4%	4.8%	-11.7%	-1.5%
Unemployment rate c or u graduates	-5.3%	-3.8%	7.7%	1.3%	3.9%	11.9%	-15.6%	-0.2%
Trend	-2.4%	1.5%	1.0%	-0.1%	-1.8%	0.3%	-1.5%	3.0%
National GDP growth rate	-1.6%	-0.5%	2.0%	0.1%	-2.6%	4.2%	-2.2%	0.6%

After age, the effect size of job availability is the highest in the model. Although we found a stronger effect for age, this was countered by age squared, resulting in a modest U shaped age-migration relationship. We also found relatively strong effects for the ‘field of study’ dummies and for the correction factors related to study duration and interval between graduation and questionnaire.

Appendix 3.C: trend and business cycle analysis

In Table 3.C.1, we show the results from four variants of the models presented in Tables 3.5 and 3.6. Model 1 contains only the trend and national GDP growth rate variables and, through models 2 and 3, progressively more groups of control variables are added, resulting in the final model (4) in the far right column. The focus is on the effects of the control variables on the trend and business cycle variables.

In model 1, we find a general negative trend in migration between NUTS 1 regions, a strong positive trend for moving abroad for university graduates, and a positive effect of the business cycle on migration in our baseline models. This is generally in line with our presentation in Section 3.2. Adding the demographic and study controls, as well as information on internships, work experience and further education in models 2 and 3 does not lead to substantial changes in the estimates related to trend and national GDP growth rate. However, on entering the economic covariates, more substantial changes occur for the trend variable. For college graduates, we now find positive trends. Less dramatically, for university graduates, the negative trend in longer distance migration becomes insignificant. As such, regions appear to be able to retain graduates when they are doing better economically. Nevertheless, we still find that graduates are more mobile when the economy is doing well, the only exception being the probability of moving between NUTS 1 regions for university graduates where an insignificant effect is found.

Table 3.C.1: Model versions, varying sets of control variables, effect on trend and business cycle indicators, college and university graduates.

Controls Entered	Multinomial Logit model versions (Stay is reference category)											
	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Field of study	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Study duration and observation window	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Internships, work experience, further education	No	No	No	No	No	No	No	No	No	No	No	No
Regional economic characteristics	No	No	No	No	No	No	No	No	No	No	No	No
College												
Trend	<i>Model 1</i>			<i>Model 2</i>			<i>Model 3</i>			<i>Model as per Table 3.5</i>		
	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Move Within NUTS 1	Move Between NUTS 1	Move Abroad
	-0.02 *	-0.08 ***	-0.09 ***	0.00	-0.06 ***	-0.04 **	0.01	-0.05 ***	-0.05 **	0.04 ***	0.03 ***	0.00
National GDP growth rate	<i>Model 1</i>			<i>Model 2</i>			<i>Model 3</i>			<i>Model as per Table 3.5</i>		
	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Move Within NUTS 1	Move Between NUTS 1	Move Abroad
	0.01 *	0.03 ***	0.02	0.01	0.02 **	0.00	0.01	0.02 **	-0.01	0.00	0.03 ***	0.02
University												
Trend	<i>Model 1</i>			<i>Model 2</i>			<i>Model 3</i>			<i>Model as per Table 3.6</i>		
	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Move Within NUTS 1	Move Between NUTS 1	Move Abroad
	0.05 ***	-0.04 ***	0.24 ***	0.04 ***	-0.06 ***	0.25 ***	0.05 ***	-0.05 ***	0.24 ***	0.02	0.00	0.26 ***
National GDP growth rate	<i>Model 1</i>			<i>Model 2</i>			<i>Model 3</i>			<i>Model as per Table 3.6</i>		
	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Move Within NUTS 1	Move Between NUTS 1	Move Abroad	Move Within NUTS 1	Move Between NUTS 1	Move Abroad
	0.08 ***	0.03 ***	0.08 ***	0.06 ***	0.02 **	0.09 ***	0.06 ***	0.02 *	0.08 ***	0.09 ***	0.00	0.07 ***

4. Entry into working life: spatial mobility and job-match quality of higher educated graduates

ABSTRACT⁵ - In this chapter, we investigate the impact of spatial mobility on the job-match quality. We use a micro-dataset on young Dutch graduates that enables us to operationalise job-match in terms of labour market outcomes such as salary, contract length, hours worked, and horizontal and vertical matching, alongside more subjective assessments of the quality of the match between job, education and skills. We find positive salary returns related to migration. However, after controlling for the self-selection of migrants, we no longer find an effect of migration on the wage rate for university graduates and a negative return on migration for college graduates. We also find that, in general, controlling for self-selection strongly reduces the effect of migration on the job-match quality based on our alternative measures. In some cases, the returns on migration are found to be negative. These counterintuitive results suggest that forced migration may affect the job-match of recent Dutch graduates.

Keywords: Regional labour markets; Return on geographic mobility; Recent graduates

JEL classification: J61, R23, J24, I21, J31

4.1 Introduction

A well-known conclusion from economic analyses of geographic mobility is that migrants move towards regions with higher income levels (Sjaastad, 1962, Borjas *et al.*, 1992). This can in principle be explained by the theory of compensating wage differentials. Workers desire jobs near their place of residence, and dislike commuting or migrating for jobs. Therefore, in the latter situation, they seek compensation for

⁵ Chapter based on Venhorst, V.A. and F. Cörvers (2010) Entry into the Working Life: Spatial Mobility and Job-Match Quality of Higher Educated Graduates. NARSC Conference, 10th - 13th November 2010, Denver, CO, USA.

their discomfort or, more positively formulated, for their investment in migration. In addition to the higher income levels, migration may also be driven by avoiding, or escaping from, unemployment (Herzog jr. *et al.*, 1993, Pissarides and Wadsworth, 1989). Büchel and Van Ham (2003) demonstrated that spatial flexibility reduces the likelihood of being over-educated for one's job.

An alternative theory for explaining higher wages for the more mobile is that certain personal characteristics that influence the likelihood of finding a good job-match, such as ability, are correlated with mobility. Human capital theory predicts that the returns on investments in job searching will be higher for the more able: information processing skills, or the ability to learn, increase the likelihood of a successful outcome, over and above the effect of a larger spatial search area and the associated increase in opportunities.

Demand-oriented theories however predict that if employers in a region have an informational advantage above those outside the region, they will be able to attract the best workers in the labour market (Thurow, 1975). Consequently, workers and graduates who are further down the "labour queue", because they are less able and therefore more expensive to train, are forced to leave the region. This unfavourable status may in turn lead to lower rather than higher wages in the destination region. In the literature, this latter group is sometimes referred to as "forced migrants", sometimes identified by their inferior labour market situation before the move took place, or by the inferior outcome of the move itself. Also, unobserved constraints on mobility, for example related to one's household situation, a lack of financial means or the opportunity to move, or a preference to stay that outweighs a potentially inferior labour market outcome, could play a role. For these 'constrained migrants', inferior outcomes in terms of job-match quality may also be observed due to the limited search area.

As a result, depending on the dominant mechanism, both positive and negative empirical relationships between spatial mobility and job-match quality can be expected. In this chapter, we aim to shed light on the relationship between inter-regional mobility and job-match quality using a sample of recent college and university graduates. The first question is whether finding a job at a larger distance pays off: does geographic mobility lead to a better job-match, or are both migration and job-match determined by a third factor? This could be an observable personal characteristic, such as education, or unobservable characteristics like innate ability that influence spatial search effort. For local policymakers, it is useful to know whether gains from migration are related to adverse circumstances in local labour markets elsewhere or, conversely, whether they are related to individual factors that influence the probability of a successful outcome of a move.

In the empirical part of this chapter we first, using an OLS model and controlling for ability and other observed personal and regional characteristics, show the general effects on the wage rate of finding work at larger distances from college or university. In the next step, following recommendations in the literature, we correct for self-selection, so as to avoid bias in the effect of post-graduation mobility, by applying a treatment-effects regression approach. We then compare the outcomes in terms of wages with alternative job-match measures. It is possible that wage rates will not differ greatly across the country due to central wage bargaining. Other elements of the contract, such as hours worked, whether the job is long-term, and a good match with the level of education and academic discipline can be regarded as outcomes of the search process alongside salary. It may be that spatial differences in terms of these dimensions are more profound. In this step, we use bivariate probit models. We find that, in general, geographical mobility and wages are positively correlated. Similarly, we find a positive effect of spatial mobility on a range of other job-match characteristics. However, after correcting for personal characteristics related to mobility, including pre-study mobility, we find that the general effect of mobility on wages is no longer significant, and in some cases even negative.

This chapter is organised as follows. In Section 4.2, we present an overview of the relevant literature. Next, in Section 4.3, we discuss our estimation strategy and present the data and sample statistics. In Section 4.4, we present our results regarding the pay-off for migration in terms of wage rate, followed by an elaboration on differences related to fields of study, gender and a variety of other job-match measures. Section 4.5 discusses the findings and draws conclusions.

4.2 Literature review: the return on interregional migration

In the economics literature, migration is considered as a response to observed or expected income differences. Sjaastad (1962) pointed out that if the expected gain of a move exceeds the costs associated with it, migration will take place. He found that migrants did flow in the expected direction - to higher wage regions. Following this line of thinking, a substantial literature has emerged that treats inter-regional migration as a form of spatial job searching. In these studies, a successful outcome is not only defined in terms of income (or improvements therein) but also, for example, as an escape from unemployment. Herzog jr. *et al.* (1993), in a survey of the literature, found that, in general, migrants tend to avoid regions with relatively high unemployment rates (see also Pissarides and Wadsworth, 1989).

Higher skilled individuals show higher levels of spatial mobility. Herzog jr. *et al.* (1985) distinguish between initial and acquired knowledge, the latter being

operationalised as knowledge resulting from past mobility. Their findings suggest that first-time movers have to exert greater search effort in order to make up for their lack of knowledge. Individuals with high human capital do not necessarily possess higher levels of pre-move knowledge, but are at an advantage when it comes to acquiring, evaluating and processing pre-move information. This, combined with the higher returns in destination regions, leads to higher rates of spatial mobility for the higher skilled as it reduces both the costs of migration as well as the risks of an inferior outcome. However, the extent of information advantage from prior mobility does not always lead to higher returns. For example, Hunt (2004, p. 845) highlights a group of returning migrants who are identified as a “heterogeneous group of failures and successes” insofar as their labour market outcomes are concerned.

It is therefore not clear whether migration actually leads to a better job, or whether it is other factors, such as the skills level or economic circumstances in departure and destination regions, that drive the positive association between spatial mobility and financial return that is often found. The literature on the relationship between migration and what we, in this chapter, refer to as the quality of the job-match (i.e. not only income but also having a job that matches one’s education) has considered aspects such as self-selection, information gathering and regional economic circumstances. The approaches adopted have been rather diverse (Herzog jr. *et al.*, 1993), leading to quite different results. Sometimes, substantial positive returns are found but, in others, zero or even negative returns have been reported. Subtle differences in the specific econometric approach, the type of migration being studied and the nature of the counterfactual could be at the root of these differences. Below, we summarize the main findings of earlier research in this field, to illustrate these points.

One potential source of variation is the extent to which studies control for self-selection among potential migrants. Borjas *et al.* (1992) elaborate on the work by Roy (1951) and develop a model of migration that serves to explain selection on the basis of the skill level of the migrant. They point out that skilled migrants are likely to move into regions where the skills premium is high relative to the local mean wage level. Conversely, low-skilled migrants typically select destination regions where this skills premium is low. Their empirical findings suggest that migrants select destinations that feature a reward structure that matches their skills (or lack of). Looking at international migration, Borjas (1987) shows that self-selection processes are influenced by factors relating to both the destination area as well as the home region. Hunt and Mueller (2004) studied cross-border migration with a sample of US and Canadian workers and found border effects in addition to a relationship between skill migration and the returns on those skills in some provinces.

Search effort and skills are difficult to capture in survey data, as are other individual-level effects that are likely to influence both the tendency to be spatially mobile and the return on this behaviour. Given this, retrospective information on, for example, an individual's income prior to migration has been used in previous studies as a proxy for these unobservables. Gabriel and Schmitz (1995) find support for the idea of favourable self-selection, in the sense that prospective migrants exhibit higher income levels prior to migration than comparable non-migrants. Nakosteen *et al.* (2008) separately consider observable as well as unobservable characteristics for a sample of Swedish men and women. They found evidence for self-selection based on unobservables, as well as self-selection on the basis of pre-migration income for women - with higher income women found to be less mobile.

As an alternative approach, some researchers rely on either Heckman selection models (Heckman, 1979) or the somewhat more general treatment-effect regression models in controlling for selectivity. Nakosteen *et al.* (2008) apply this latter approach when attempting to isolate unobserved migrant characteristics. Nakosteen and Westerlund (2004) investigated the return on inter-regional migration, for previously employed and unemployed groups, in a treatment-effects framework and found that migration has positive effects on earnings, and that there was a negative correlation between the selection and outcome equations. That is, even though the payoff from migration is positive, those with a higher propensity to migrate tend to achieve less favourable wage gains. Smits (2001) initially found positive returns on migration for a sample of Dutch married men and married women but, after controlling for self-selection, the effect was negative for both groups. The author highlighted a less favourable labour market situation for the migrants before they moved. In other words, forced migration and the ensuing less favourable negotiating position could play a role. Similarly, Axelsson and Westerlund (1998) studied household migration in Sweden and found no post-migration income gains after correcting for self-selection. Dostie and Léger (2009), on the other hand, had findings that are more in line with Borjas' (1992) selection approach, with Canadian physicians with a higher earnings potential more likely to move to regions where the returns to the underlying unobservables are higher.

A third and related strand of literature discusses the accumulation of skilled employees in regions and finds that skilled regions tend to draw in yet more individuals with high human capital. Agglomeration effects and the resulting increases in productivity and wages are put forward as an explanation (Berry and Gleaser, 2005, Faggian and McCann, 2006). Scott (2010) discusses how different types of human capital accumulate in different areas, according to the nature of the skills involved. Analysing a sample of young French migrants, Détang-Dessendre *et al.* (2004) found

that skilled migrants from regions with relatively small labour markets positively self-select for migration towards areas with more sizeable labour markets.

Other contributions point to two methodological issues that could be behind this diversity in results: the time horizon and the selection of appropriate reference groups. Krieg (1997) studied the return on migration for up to three years after migration, specifically taking into account whether migrants changed occupations, employers or both. Migrants that do not change employers can be thought of as taking a “low cost migration avenue” as Hunt (2004, p. 832) puts it. Krieg (1997) notes that not taking these different types of migration properly into account biases the relationship found between migration and pay-off. The author finds virtually no evidence for remaining selection effects once these aspects are included. Yankow (2003) investigated the return on migration over time in a study on migrant versus non-migrant job-changers. It was found that the returns for skilled migratory job-changers only became positive after almost two years, relative to the pay of non-migratory job-changers. Conversely, the authors found immediate returns low-skilled workers changing jobs and locations. Lehmer and Ludsteck (2010) also highlight the importance of selecting proper reference groups in their study on returns for job-changers that only change employer, relative to those who also changed regions. They found the highest returns for rural-to-urban migrants and for young migrants. Returns on migration only accrue after a time-lag for the more highly educated workers.

From the above overview it has become clear that migrant heterogeneity is a crucial factor in trying to analyse the return on migration. This chapter acknowledges this issue by focussing on a very homogeneous group of migrants: recent Dutch college and university graduates. Studying this particular group ensures a degree of homogeneity insofar as the relationship between job change and migration is concerned. Our sample is consistent in the sense that, after completing their education, they are all entering the labour market and seeking a return on their investment in education. The degree of mobility is the key differential, while there will also be various individual demographics and study-related backgrounds at play. Similar approaches have been employed by Dahl (2002) for the case of the United States, Eliasson (2011) for Sweden and Abreu *et al.* (2010) for the United Kingdom. Elsewhere it has been noted that the inflow of highly able graduates has positive effects on regional development (Faggian and McCann, 2006), making this particular group a relevant policy focus. This regional effect is maximized if graduates are able to fully exploit their talents by achieving a good match on the labour market. Recent graduates have been found to be particularly spatially mobile as, following graduation, they seek to achieve a good match on the labour market in order to get a good return on their investment in education. Of the studies discussed earlier, Gabriel and Schmitz

(1995), Yankow (2003) and Détang-Dessendre *et al.* (2004) all focussed specifically on younger migrants, albeit with varying levels of education.

Secondly, it has also become apparent from the literature that one needs to control for differences in skills as well as differences in economic circumstances in departure or destination regions. Further, one cannot ignore the possibility that unobservable factors, such as effort and motivation, could also play a role. In line with the literature, we therefore seek to control for self-selection in our analysis. Alongside entering the observable characteristics discussed above, we attempt to control for unobserved characteristics by taking into account any correlation that may exist between the propensity to migrate and the outcome in terms of job-match. Finally, we see from the literature that different processes may be relevant for different sub-groups in the labour market. We will therefore present an analysis for a variety of such sub-groups, notably graduates from specific academic disciplines and according to gender. In the next section we will outline our econometric approach and the dataset that was used in this study.

4.3 Method and data

4.3.1 Method

In previous studies on the relationship between migration and the resulting pay-off, a number of different econometric strategies have been applied in order to correct for endogeneity between the migration decision and the resulting labour market match. The key issue in these types of analyses is that individuals do not randomly divide into migration and non-migration trajectories. Rather, those individuals that stand to gain the most from such a move are more likely to migrate. Critically, the characteristics that drive this mechanism may be invisible to the researcher. In this chapter, we follow Nakosteen and Westerlund (2004), among others, who estimate the effect of migration on income change using a treatment-effect framework. In such an approach, the outcome equation can be thought of as having the form:

$$Y_i = X_i\beta + \delta M_i + \varepsilon_i$$

where the parameter δ measures the effect of a move (indicated by the dummy M_i) on outcome variable Y_i (in the context of this chapter, either the wage rate or an alternative job-match indicator), given a set of observed controls X_i . Crucially, if endogeneity is an issue, the parameter δ will be biased as it picks up not only the effect of migration but also unobserved characteristics of those that are mobile. For example, if the propensity to be mobile is positively correlated with the propensity to realize a favourable job-match for reasons that are unobserved or not included in the model (and

hence, with ε_i), parameter δ is biased upwards. The selection process is then accounted for in the probit selection equation:

$$m_i = Z_i\gamma + u_i$$

where Z_i is a set of variables which are thought to explain the migration decision, and this can overlap with X_i since the treatment-effects model is identified even if $Z_i = X_i$. We add a number of additional variables to Z_i in order to aid identification. Latent migration propensity m_i as such is not observed. Rather, one observes M_i , with $M_i = 1$ if $m_i > 0$, and $M_i = 0$ for $m_i \leq 0$.

In our analysis of the log wage-rate, we estimate a treatment-effects model, featuring a probit selection model and a linear outcome equation. Error terms ε_i and u_i are assumed to be correlated through the variance / covariance matrix:

$$\begin{bmatrix} \sigma^2 & \rho\sigma \\ \rho\sigma & 1 \end{bmatrix}$$

In the two-step approach to estimating this class of model, the outcome equation is augmented with the inverse Mills ratio, in our case the individual hazard of selecting migration. Often, its coefficient is denoted by λ : the product of the correlation between ε_i and u_i , i.e. ρ , and the regression standard error σ ($\lambda = \rho\sigma$). In our study, however, we apply full information maximum likelihood using Stata's `treatreg` routine with heteroskedasticity-robust standard errors. The maximum likelihood estimator is based on the work of Maddala (1983). This method will yield an estimate of parameter λ through estimations of both ρ and σ . Parameter λ can be interpreted as the strength and direction of the selection effect in the specification, inclusive of the selection process already accounted for by the model structure. The significance levels reported are derived from a Wald test on $H_0 \rho = 0$ (equivalent to testing $\lambda = 0$ since $\sigma > 0$) and in our results we are therefore reporting the estimate for ρ . Failure to reject H_0 leads to the conclusion that independence between the selection equation and the outcome equation cannot be rejected. A rejection of H_0 is an indication that selection may be an issue. The propensity to be mobile that is added to the outcome equation need not play a very strong role in itself, but controlling for it through the model structure could lead to different results for δ , than when using the OLS alternative. We therefore report 'naïve' OLS results alongside our treatment-effect regressions and discuss the differences where appropriate.

In this chapter, we aim not only to measure the effect of migration on wages, but also on a variety of other dichotomous variables. In these instances, we apply a seemingly unrelated bivariate probit analysis, again in order to take account of any correlation between the error terms of the selection and outcome probit equations. For

these models we report the value of the correlation coefficient ρ , and the significance level is again based on the Wald test on $H_0 \rho = 0$.

Interpreting ρ and δ requires some care. Parameter ρ can be thought of as an indication of the relationship between the propensity to be mobile and job-match, with the effect of actual mobility captured by δ . Not everyone with a high propensity to be mobile will actually move however, perhaps due to unobserved constraints on spatial mobility (these could be termed ‘unexpected’ stayers) such as tied partners, or those with a desire to stay that outweighs a potentially inferior outcome on the labour market. In the literature, attention has also been given to home ownership in this respect, although Van Leuvensteijn and Koning (2004) show that home ownership is more associated with job certainty. A strong positive value for ρ can also be interpreted as an indication that constrained migrants have been able to achieve a good job-match for reasons that we are not able to observe. Conversely, a significant negative value for ρ indicates that constrained migrants have not been able to find a good match, also for reasons that we have not observed. This would form a relevant starting point for setting policy.

A similar line of reasoning is applicable when considering δ . This denotes the return on actual migration, given the estimated propensity to be mobile. For example, graduates that are expected not to be mobile on the basis of their background characteristics may in fact be observed as being relatively mobile (“unexpected” movers). A significant negative value for δ is then an indication that forced migration is relevant, with an unfavourable outcome as a result. This too could be a motivation for new policy. Alternatively the move may have been motivated by factors that are regarded as more important than the quality of the job-match, such as amenities in the destination region (see, for example, Graves and Linneman, 1979). A significant positive value for δ is an indication that not all the factors leading to a favourable return on migration have been observed. In particular, negative effects of constraints on migration as well as negative results of forced migration could be grounds for labour market policies. While the reasons for these effects may not be observable to the researcher, identifying the relevant groups could provide a useful starting point for developing policy.

4.3.2 Data and job match measures

4.3.2.1 Sample

In our analysis, we use data drawn from the ROA School-leaver Information System (ROA-SIS) on recent college and university graduates. Each year, a cohort of graduates is surveyed, reflecting a representative cross-section. All universities and

most colleges participate, resulting in near complete coverage of the Netherlands. Graduates are surveyed approximately eighteen months after they have graduated. Extensive information is collected on both the graduates' educational backgrounds as well as their current jobs. The information on the current job includes income, hours worked, type of contract and a variety of other indicators of job-match quality. Data from the 2006 to 2008 cohorts of this annual survey were used as, in these years, information on the graduates' home regions was included. Further, we selected only graduates aged between 20 and 30 who had participated in full-time education. These constraints were imposed to arrive at a more homogeneous sample. It left us with a sample of approximately 16,100 college graduates and 8,500 university graduates.

Our sample excludes those graduates who were unemployed at the time of the survey. However, given that the unemployment rate amongst recent graduates was low, we would not expect this to impact on our results. Also, our analysis did not include those graduates that, at the time of the survey, were still active in follow-up education, such as an additional MSc programme. Participating in follow-up education could be seen as an additional investment in human capital, for which a return from the labour market can be expected, although it may take some time before these benefits materialize. Those that are still enrolled in full-time follow-on programmes often work in low-skilled, part-time jobs that do not reflect any attempt at a proper job-match. In our analysis, we control for previous participation in such follow-on education by graduates who had successfully completed such a programme by the time of survey.

From earlier research (Venhorst *et al.*, 2010), it was apparent that the propensity to migrate differs considerably between university and college graduates and, therefore, we analysed college and university graduates separately. Sample statistics on endogenous and exogenous variables are consequently presented in Table 4.1 for college and university graduates separately.

4.3.2.2 Endogenous variables: job-match quality and spatial mobility

In this section we discuss our measures for the quality of the job-match. Firstly, we follow the existing literature by using the natural log of the hourly wage rate as a dependent variable. However, especially for the particular group studied in this chapter (new entries on the labour market), income differences are likely to be limited. This is not only because our subjects are still at the beginning of their careers but also a result of central wage bargaining arrangements which are common in the Netherlands.

Therefore, alongside wage rate, we also study the effect of migration on a wider range of job-match measures which could also be relevant as elements of a job offer. We do not explicitly assume that all aspects of a job-match are equally sought-

after or important for young starters. In fact, differences in the return on spatial mobility for these various job-match measures could be indicative of the willingness to move to acquire an improvement on a specific aspect of the job. We investigate whether migration increases the likelihood of acquiring a job that comes with a permanent contract, a job that is full-time, at the correct level (a horizontal match) and in the appropriate field (a vertical match). To these measures, we add two, somewhat subjective measures of job-match quality. Firstly, we include the respondents own assessment of the match between their education and the job requirements. Respondents were asked whether they felt that their job matched the skills they acquired at college or university. Secondly, we used the answer to the question “are you currently looking for another job?” as a very general indicator of job-match. The first of these is a rather specific measure of the perceived quality of the job-match, whereas the latter could be related to a host of other job- and non-job-related factors. That is, graduates may be looking at other job options for reasons unrelated to their current job as such.

From Table 4.1 it can be observed that college graduates, even though they appear on average to be earning slightly less, do marginally better in terms of the other job-match indicators, with the exception of “having a full time job”, than their university counterparts. Differences between the groups were smallest for the subjective indicators of “self-evaluation of job match” and “not looking for other work”. The variable M_i , labelled “relatively high post-graduation migration”, in the context of this chapter is a dummy that describes a graduate’s migratory behaviour relative to their peer group. Our focus is on a move from the study location to a job location. The major economic area in the Netherlands is around the larger cities in the western part of the country and this also has the highest density of colleges and universities. For graduates from these institutions, high spatial mobility is not required to access opportunity-rich labour markets. Therefore, we need to look at migratory behaviour in a relative sense, i.e. is a graduate more spatially mobile than their peer group? The peer group consists of all other college or university graduates from the same NUTS 2 study region who have graduated in the same academic discipline and in the same year. The dummy variable M_i equals 1 if the distance covered by graduate i is equal to, or greater, than the average distance covered by their peer group, and 0 otherwise⁶. In this way, the dummy variable does not capture mobility as such, but

⁶ We opted to delineate migratory groups based solely on relative distance traversed. No additional regional, border or distance-based thresholds were imposed that would have to be exceeded before someone was referred to as relatively mobile. Any such additional thresholds would have been difficult to specify in a space-neutral way (having taken regional specifics out of the equation by computing a relative measure) and hence would run the risk of being arbitrary. In terms of robustness checks, we also ran our wage-rate analysis with a continuous variant of this distance-based relative migration variable in a 3SLS framework. The results are qualitatively the same as those reported based on a dummy variable. Alongside this, we

whether the graduate has opted for greater spatial mobility in order to reach a job location than graduates in similar situations.

Table 4.1: Sample statistics: college and university graduates.

	Mean	College Std. Dev.	Min	Max	Mean	University Std. Dev.	Min	Max
<i>Job match indicators</i>								
LN(Hourly Wage)	2.56	0.24	0.62	4.55	2.71	0.21	1.28	4.36
Permanent Contract	0.59		0	1	0.53		0	1
Full Time Job	0.76		0	1	0.82		0	1
Level Match	0.83		0	1	0.58		0	1
Field Match	0.81		0	1	0.72		0	1
Good Match (subj)	0.77		0	1	0.76		0	1
Not Looking For Other Job (subj)	0.84		0	1	0.82		0	1
<i>Spatial mobility</i>								
Rel. mobile study to job location	0.33		0	1	0.35		0	1
Rel. mobile home to study location	1.03	0.96	0.00	9.19	1.03	0.75	0.00	8.15
Lived in Core at age 16	0.41		0	1	0.45		0	1
<i>Demographics</i>								
Male	0.43		0	1	0.46		0	1
Age	24.51	1.83	20	30	26.31	1.72	21	30
Foreign born EU	0.01		0	1	0.02		0	1
Foreign born Non-EU	0.02		0	1	0.02		0	1
Parent(s) foreign born	0.09		0	1	0.09		0	1
<i>Human Capital</i>								
Low grade [6,7>	0.12		0	1	0.09		0	1
Medium grade [7,8> (ref.)	0.65		0	1	0.68		0	1
High grade [8,10]	0.23		0	1	0.23		0	1
Study duration in months (/100)	0.47	0.12	0.06	1.20	0.54	0.27	0.01	1.43
Internship					0.70		0	1
Relevant work experience	0.51		0	1	0.47		0	1
Management experience	0.20		0	1	0.39		0	1
Study abroad	0.07		0	1	0.16		0	1
Internship abroad	0.15		0	1	0.18		0	1
Follow-on education	0.11		0	1	0.10		0	1
<i>Transition study – job</i>								
Duration finals - questionnaire, months (/100)	0.18	0.03	0.12	0.31	0.19	0.04	0.12	0.30
Months unemployed (/100)	0.01	0.02	0.00	0.19	0.01	0.03	0.00	0.18
<i>Regional economic characteristics</i>								
# suitable jobs dest t-1 (/1000000)	0.30	0.13	0.06	0.48	0.32	0.12	0.06	0.48
mean housing value dest t-1 (%)	0.27	1.14	-3.00	1.60	0.47	1.03	-3.00	1.60
reg econ growthrate dest t-1 (%)	0.14	1.09	-5.60	1.90	0.22	0.92	-5.60	1.90
reg unempl rate grads dest t-1 (%)	4.10	1.22	0.00	6.83	3.57	1.12	0.32	5.83
<i>Year of observation and field of study</i>								
2006 (ref.)	0.35		0	1	0.42		0	1
2007	0.29		0	1	0.37		0	1
2008	0.36		0	1	0.20		0	1
Agriculture	0.04		0	1	0.06		0	1
Teaching	0.13		0	1				
Engineering	0.22		0	1	0.17		0	1
Economics	0.34		0	1	0.19		0	1
Healthcare	0.10		0	1	0.10		0	1
Behavioural Sciences (ref.)	0.16		0	1	0.24		0	1
Humanities					0.10		0	1
Law					0.08		0	1
Natural Sciences					0.06		0	1
Valid N	16123				8531			

analysed the return on migration using non-relative measures, such as a dummy indicating whether a graduate left the administrative region (NUTS 1, 2 or 3) of study. Again the results are similar, albeit that selection proved to be less of an issue as we reduced the stringency of the migration threshold. Naturally, if regional classifications become sufficiently small, everyone becomes a migrant.

4.3.2.3 Independent variables

Our earlier review of the literature suggested a number of potentially relevant explanatory and control variables. These include measures of skills, controls for regional economic circumstances and demographic characteristics. Below, we present the exogenous variables that, on this basis, were included in our analysis.

Firstly, we are interested in the effect of ability in a broad sense since, from the literature, it is clear that human capital factors could be the driving force behind endogeneity issues in the relationship between migration and job-match quality. We include dummies for graduation grade to control for academic ability. However, Van der Klaauw and Van Vuren (2010), in their study of Dutch graduates, noted the limited effect of graduation grade on income. Diverting effort from studying into finding a good job in the final year of studies is also not a guarantee of success, as these authors point to labour market conditions, such as the unemployment rate, as important explanatory factors. Venhorst *et al.* (2010) considered the relationship between academic discipline, ability and migratory propensity among Dutch college and university graduates and found that graduates with higher final grades were not necessarily more mobile. For some study subjects, a labour queue model appears to reflect the reality, with the better graduates achieving good local matches whereas others have to move elsewhere. This also relates to the apparent instances of “forced migration” found in some of the studies discussed earlier. The returns on migration could therefore differ substantially between graduates from different fields of study.

Further, given that our sample is made up of new entrants to the labour market, and the somewhat modest effects of the graduation grade as discussed above, it could be useful to control for other factors that enhance human capital such as managerial experience, maybe within a student society, internships (included only for university graduates since virtually all college graduates serve an internship), relevant working experience or experience abroad, as these could be valued by employers when selecting young employees. We also controlled for the time spent completing the college or university programme, as a general measure of skill, and measured as months divided by 100. This information is combined with the dummy variables for graduation grade category to control for observed effects related to human capital, with higher levels of human capital expected to positively influence job-match quality.

Secondly, it is essential to control for the opportunities and constraints present in the working region as these alter the negotiation balance between employers and job-seekers. From Cörvers *et al.* (2009), we concluded that these labour market indicators could be sensibly entered at the level of the NUTS 2 working regions. These regional variables are entered with a one-year lag, and are assumed as a given for the

individual graduates. They are entered for the NUTS 2 region (i.e. province) of the current job and are intended to pick up the effects of amenities and the general economic and labour market circumstances on migration and job-match quality.

First, we enter the number (in millions) of workers in higher and scientific jobs in a region's active labour force. This measure of the labour market reflects the number of relevant job opportunities in the working region.

Secondly, we enter the region's relative cost of living ($COL_{i,t}$), operationalised by taking the average value, on the NUTS 2 level, of family homes, as a percentage of the national average. If $P_{i,t}$ is the average house price in region i at time t , then

$$COL_{i,t} = (P_{i,t} - P_{NL,t}) / P_{NL,t}$$

The result is a variable with values generally close to zero, with positive values indicating that home prices in that region are relatively high.

Thirdly, the regional economic growth rate (REGG) is included, again relative to the national growth rate. This results in a variable with a zero mean, and positive values for regions with above-average development. If $R_{i,t}$ is the rate of growth in regional GDP, and $R_{NL,t}$ the rate of growth in national GDP at time t , then:

$$REGG_{i,t} = R_{i,t} - R_{NL,t}$$

Fourth, the regional unemployment rate, calculated specifically for recent graduates, $U_{i,t}$, is entered in the model as a measure of the prevailing labour market conditions. Using the ROA-SIS dataset, $U_{i,t}$ is been computed as the percentage of college or university graduates notionally within the labour force, but looking for work.

Wages are generally expected to be higher in larger labour markets, and these usually contain large cities, so, in effect, we expect to find agglomeration externalities in line with the literature. Wages are also expected to be higher in regions that are relatively expensive to live in, regions with lower unemployment rates and regions boasting higher economic growth rates. We would expect similar effects on the job-match measures in general.

We also controlled for the length of the period between graduation and the survey (months / 100). Although graduates are surveyed approximately eighteen months after graduation, there is some variation. Within a graduation cohort, which spans a year, some receive their diploma relatively early and some later. As a result, some graduates start the job matching process earlier than others, with the possible consequence of finding a better match, possibly through greater mobility. Further, we control for the period spent unemployed before finding employment (months / 100). We would expect longer waiting times to lead to both a lower reservation wage as well

as an increase in the likelihood of a move. Finally, we entered dummy variables for the year of observation and the study field.

4.3.2.4 Additional selection equation variables

We included three additional variables, entered into the selection equations, to add identification in statistical terms to the treatment-effects models and the seemingly unrelated bivariate probit models. These variables include a dummy indicating whether a graduate lived in the central economic region of the Netherlands at age sixteen, a dummy indicating whether the graduate has one or more parents born outside the Netherlands, and one reflecting the relative degree of spatial mobility before the onset of graduate-level studies. Apart from adding to the identification of our model in statistical terms, these variables control for unmeasured effects that may affect the tendency to exert greater effort in spatially searching.

These variables capture the degree of “willingness to be mobile”, or the level of exerted past search effort. From a theoretical perspective, living in the opportunity-rich core region at age sixteen could affect later search behaviour both positively (greater awareness of possibilities) as well as negatively (these possibilities are available nearby). Having a foreign-born parent could lower the psychological costs of being spatially mobile. Previous research has found that those that have been mobile in the past, are more likely to move again (DaVanzo and Morisson, 1981). A past migrant has previously incurred the cost of moving and, additionally, in the case of a returning migrant, has existing knowledge of the destination region.

Spatial mobility before the onset of study, as measured here, reflects the distance between a student’s home region (residential area at age 16) and the study location. Defining the home region in this manner, rather than using the region of birth for example, better reflects the theoretical decision-making and spatial information gathering framework that underlies this variable (Newbold, 2001). Relationships with the area of birth may have weakened over time, whereas the degree of spatial awareness is likely to be fairly high by the age of sixteen. As with the post-study migration dummy, it is measured in relative terms, each individual is compared to a peer group of students, from the same graduation cohort and hailing from the same home region, that enrolled in the same field of study at the same (college or university) level. Unlike the post-study migration dummy M_i , this variable is entered in terms of the ratio of the distance moved by graduate i to the average distance traversed by the peer group, excluding graduate i . Values > 1 indicate relatively high levels of spatial

mobility, whereas values between 0 and 1 indicate below average levels of spatial mobility. The mean value is close to 1, but not exactly 1 as could have been expected⁷.

Statistically, these three variables are required to be unrelated to the job-match element being studied in the outcome equations. We formally tested whether this requirement was satisfied for the three variables in all the treatment-effect models. In some cases, one of the variables did not meet this requirement and was consequently also added to the outcome equation. Table 4.B.1 in Appendix 4.B includes the results for the relevant identification tests. From Table 4.B.1 it can be seen that the resulting specifications satisfied the relevant tests, i.e. the selected variables were rightly excluded from the outcome equation while, at the same time, strongly identifying a migration propensity⁸.

4.4 Multivariate results

4.4.1 Wage equation

In this section, we discuss the estimation results for the impact of geographic mobility on hourly wage rate, controlling for various characteristics and the endogeneity of the mobility variable. Table 4.2 shows both the estimated OLS model, the selection probit model for migration and the outcome treatment-effects model for college graduates.

The top row in Table 4.2 shows the results for the main variable of interest: mobility from study to job. The coefficient δ for this migration dummy shows strikingly different results between the OLS model and the treatment-effects regression. In the OLS model, this effect is positive and statistically significant; suggesting that college graduates with above average geographic mobility have a 1.1 per cent higher hourly wage. However, the positive and significant ρ in the treatment-effects model suggests that spatial mobility and wages are positively correlated, indicating that self-selection plays an important role in this outcome. After controlling for this selectivity, the effect of post-graduation mobility on wages is significantly negative. That is, after controlling for both selection and the effect of the other covariates, spatial mobility has a negative effect on the wage rate of college graduates. This suggests that the positive pay-off for migration for this group is due not to the move as such, but to individual unobserved characteristics that make both higher

⁷ This is a result of both weighting the raw data to better match the true graduate population, as well as adjusting the observed means for those graduates whose peer group consisted of less than ten others. In these cases, they were assigned peer values derived from more aggregated levels, such as the larger NUTS 1 region rather than the NUTS 2 region.

⁸ We also applied the selected variables as instruments for the key endogenous dummy variable “spatial mobility from study to work location” in an instrumental variable regression. The results are qualitatively the same as those reported for the treatment-effects regressions in Section 4.4.1.

wages as well as spatial mobility more likely. Further, the negative value for δ suggests that forced migration may play a role. Limited opportunities in some regions may force college graduates to look elsewhere and accept lower wages as a result of a poor negotiating position.

We continue the discussion by considering the other covariates. The estimated coefficients for the wage equation are very similar in both models. Wages are found to be higher for males, those with above average grades, with experience as a member of a student board, with relevant work experience and, perhaps more surprisingly, those who have spent more years completing their studies. Also, wages are higher for those working in larger labour markets and more expensive regions. However, wage rates are negatively affected by an internship abroad, perhaps because graduates find it more difficult to re-acquaint themselves with the Dutch labour market. An alternative possibility is that foreign experience is not valued by employers to the extent that was anticipated by those in this group. Wages are also found to be lower for those with a longer period of unemployment before finding a job and for graduates in the fields of agriculture, economics and teaching (relative to the reference category of graduates in behavioural sciences). Completing a follow-on education programme does not have a significant effect on wages. This could be because, given the source of the data used, these additional programmes have generally only been completed shortly before the survey, and that it takes more time to reap the benefits of this additional investment.

The probability of college graduates being relatively more mobile than their peer group is positively related to having completed an internship abroad, to the length of time unemployed before finding work, and for regions with relatively expensive housing and high unemployment rates. A particularly strong positive effect was found for pre-study mobility, and also a positive effect of having at least one foreign-born parent. College graduate mobility is negatively affected by high regional growth rates. Also, those that were living in the core economic region at age sixteen tend to be less mobile on graduation. The graduates in the reference category of behavioural and social sciences appear to be relatively more mobile than graduates in engineering, economics and healthcare.

Table 4.3 shows the corresponding results for university graduates. The OLS model suggests that wages are 3.2 per cent higher for those university graduates that are relatively mobile. This effect disappears in the treatment-effects model when applying the same selectivity correction as for the college graduates above. Again, ρ is positive and significantly different from zero, indicating that the hourly wage rate for university graduates is not affected by migration, over and above the human capital and regional factors already included in the model. That is, the positive effect of

migration on wage rate found in the OLS specification was driven by issues of selection rather than being a direct effect of migration as such.

Table 4.2: Estimation results (college graduates): OLS and treatment-effects models of $\ln(\text{HourlyWage})$.

Total sample	OLS LN(HourlyWage)	Treatment-effects regression	
		Selection RelMobStJob	Outcome LN(HourlyWage)
<i>Spatial mobility</i>			
Rel. mobile study to job loc (δ)	0.011***		-0.017*
ρ			0.083***
<i>Demographics</i>			
Male	0.063***	0.039	0.062***
Age	0.036	0.008	0.037
Age Squared	-0.040	-0.029	-0.042
Foreign born EU	0.004	0.040	0.005
Foreign born Non-EU	0.013	0.083	0.012
<i>Human Capital</i>			
Low grade [6,7>	-0.032***	0.018	-0.032***
High grade [8,10]	0.016***	0.015	0.017***
Study duration in months	0.034*	0.095	0.034*
Relevant work experience	0.008**	-0.009	0.007**
Management experience	0.012**	-0.016	0.012***
Study abroad	0.002	0.036	0.002
Internship abroad	-0.011**	0.106***	-0.009*
Follow-on education	0.006	-0.011	0.006
<i>Transition study - job</i>			
Duration finals - questionnaire	0.404***	0.111	0.403***
Months unemployed	-0.871***	1.077**	-0.856***
<i>Regional economic characteristics</i>			
# suitable jobs destination (t-1)	0.153***	-0.170	0.150***
mean housing value dest t-1	0.006***	0.154***	0.008***
reg econ growthrate dest t-1	-0.001	-0.057***	-0.002
reg unempl rate grads dest t-1	0.002	0.074***	0.003
<i>Time and field of study dummies</i>			
Dummy 2007	0.028***	0.113***	0.029***
Dummy 2008	0.041***	0.162***	0.042***
Agriculture	-0.057***	-0.065	-0.057***
Teaching	-0.014*	-0.058	-0.014*
Engineering	-0.005	-0.067*	-0.005
Economics	-0.017***	-0.088**	-0.018***
Healthcare	0.078***	-0.088**	0.077***
<i>Additional controls</i>			
Lived in Core at age 16		-0.120***	
Parent(s) foreign born		0.067*	
Rel. mobile home to study location		0.491***	
Constant	1.717***	-1.375	1.704***
Adj R Squared	0.075	CHI 2	1253.399
RMSE	0.232	N	16123

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The effects of our control variables on wages are generally similar to those found for college graduates. One notable difference is that the coefficient linked to being an economics graduate is now positive. Also, internships abroad now have a positive effect, as do internships in general (an aspect not considered with college students who virtually all carry out an internship). In another difference with college graduates, we now find a negative effect of study duration on income.

From the migration model we see that university graduates are increasingly likely to be spatially mobile as the time between graduation and completing the survey increases. However, the length of a pre-work unemployment period has no significant

influence. Age is significant, and there are also positive effects for student-board experience, overseas internships and having been mobile in the past. Mobility is on average lower for university graduates who took a long time to complete their study programme, or who have completed a follow-on education programme.

Table 4.3: Estimation results (university graduates): OLS and treatment-effects models of $\ln(\text{HourlyWage})$.

Total sample	OLS	Treatment-effects regression	
	LN(HourlyWage)	Selection RelMobStJob	Outcome LN(HourlyWage)
<i>Spatial mobility</i>			
Rel. mobile study to job location (δ)	0.032***		-0.015
ρ			0.153*
<i>Demographics</i>			
Male	0.034***	-0.017	0.033***
Age	0.096***	0.648***	0.108***
Age Squared	-0.151**	-1.212***	-0.174**
Foreign born EU	-0.011	-0.186	-0.014
Foreign born Non-EU	0.024	-0.059	0.023
<i>Human Capital</i>			
Low grade [6,7>	-0.026***	-0.015	-0.026***
High grade [8,10]	0.021***	0.040	0.022***
Study duration in months	-0.023**	-0.124**	-0.026***
Internship	0.025***	0.024	0.025***
Relevant work exp	0.035***	0.017	0.036***
Management exp	0.018***	0.091***	0.020***
Study abroad	-0.004	0.007	-0.003
Internship abroad	0.015**	0.088**	0.016***
Follow-on education	-0.009	-0.118**	-0.011
<i>Transition study - job</i>			
Duration finals - questionnaire	0.424***	0.983**	0.439***
Months unemployed	-1.108***	0.225	-1.103***
<i>Regional economic characteristics</i>			
# suitable jobs destination (t-1)	0.191***	-0.327**	0.187***
mean housing value dest t-1	0.004	-0.259***	0.000
reg econ growthrate dest t-1	-0.004	0.193***	-0.001
reg unempl rate grads dest t-1	-0.001	-0.057***	-0.002
<i>Time and field of study dummies</i>			
Dummy 2007	0.019***	0.049	0.020***
Dummy 2008	0.024***	0.162***	0.027***
Agriculture	-0.033***	-1.048***	-0.048***
Engineering	-0.004	-0.397***	-0.011
Economics	0.061***	0.066	0.062***
Healthcare	0.074***	0.026	0.074***
Humanities	-0.082***	-0.126**	-0.084***
Law	0.018**	0.013	0.018**
Natural Sciences	-0.001	0.068	0.000
<i>Additional controls</i>			
Lived in Core at age 16	-0.008*	-0.157***	-0.010**
Parent(s) foreign born		-0.042	
Rel. mobile home to study loc		0.298***	
Constant	1.044**	-8.995***	0.904*
Adj R Squared	0.150	CHI 2	1381.138
RMSE	0.192	N	8531

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Again, there are some differences among the study fields. The additional control variable “living in the core region at age 16” was added to the outcome equation for university graduates because Hansen J tests indicated that this was not exogenous to the wage equation, and this was found to have a negative effect on the wage rate.

4.4.2 Differentiation by field of study, gender and job-match indicators

In this section, we take a closer look at the differences in wage premium for geographic mobility for two different academic disciplines, and between men and women by running our analysis separately for these groups. Following this, we consider the returns on mobility in terms of other job-match aspects than wages.

Earlier research (Venhorst *et al.*, 2010) shows that there are substantial differences in spatial mobility patterns between graduates from different academic disciplines. Based on these findings, summarised below, we elected to focus upon graduates in economics and healthcare. Economics graduates are a good example of a highly mobile group, moving out of peripheral regions towards the central economic area and to the larger cities in the west of the Netherlands. Migration among young recent economics graduates follows a distinctly human capital driven pattern, with the best graduates showing the highest levels of spatial mobility. Healthcare graduates, on the other hand, are less inclined to move towards this core area, and there is also no evidence that the best healthcare graduates move there. Further, especially for university-level healthcare graduates, employment location is in part determined by the availability of academic hospitals offering the desired training in a specific medical specialism. Given the nature of these migration patterns, we would expect to see considerably higher returns on migration for economics graduates than for healthcare graduates.

We also analyse the relationship between migration and wage rate separately for men and women since the broader literature on labour market participation suggests that entry decisions differ between men and women. Earlier work on the migration of Dutch graduates (Venhorst *et al.*, 2010, 2011) showed that women have a higher propensity to be mobile than male graduates, especially in considering a move from the peripheral areas towards the core region of the Netherlands. Faggian *et al.* (2007) suggest that women have to accept higher levels of spatial mobility in order to compensate for adverse circumstances in local labour markets. In this light, we would expect women to see higher returns on migration than men.

As in the earlier more-general analysis, we include our relative measures of mobility in this part based on peer groups defined on the basis of study field, year of graduation and location of university or college. Additional identifying variables were added to the selection equations in the same manner as before. For female graduates, from both college as well as university, and for college economics graduates, statistical tests indicated that the “having at least one foreign-born parent” variable influenced the wage rate. Further, as with the total group of university graduates, the “having lived in the core region at age 16” variable was found to affect the wage rate for

university economics graduates and for male graduates in general. These variables were accordingly added to the outcome equations and the results are presented in Table 4.4.

Table 4.4: Summary of estimation results (various samples and job-match measures): OLS / treatment-effect models and probit / SUR bivariate probit models.

Sample	Dependent variable outcome eq.	Treatment effects regression / SUR Bivariate Probit		
		OLS / Probit RelMobStJob	RelMobStJob	
		δ	ρ	δ
<i>College</i>				
Total	LN(HourlyWage)	0.011***	0.083***	-0.017*
Economics grads	LN(HourlyWage)	0.011	0.142***	-0.037**
Healthcare grads	LN(HourlyWage)	-0.003	-0.081	0.025
Women	LN(HourlyWage)	0.005	0.068*	-0.018
Men	LN(HourlyWage)	0.018***	0.097***	-0.015
Total	PermanCont	-0.051**	0.054	-0.131**
Total	FullTime	0.105***	0.106**	-0.050
Total	LevelMatch	0.121***	0.070	0.017
Total	FieldMatch	-0.015	0.274***	-0.416***
Total	GoodMatchSubj	0.025	0.039	-0.033
Total	NotLookingOthJob	-0.035	0.162***	-0.274***
<i>University</i>				
Total	LN(HourlyWage)	0.032***	0.153*	-0.015
Economics grads	LN(HourlyWage)	0.025***	-0.242	0.090
Healthcare grads	LN(HourlyWage)	-0.010	0.108	-0.043
Women	LN(HourlyWage)	0.037***	0.253**	-0.042
Men	LN(HourlyWage)	0.027***	0.091	0.000
Total	PermanCont	0.069**	0.058	-0.024
Total	FullTime	0.127***	-0.142	0.350*
Total	LevelMatch	0.158***	0.095	0.007
Total	FieldMatch	-0.090***	0.166	-0.354**
Total	GoodMatchSubj	0.124***	-0.029	0.171
Total	NotLookingOthJob	0.117***	-0.133	0.325*

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

We ran an analysis to consider alternative job-match measures using the full sample. In the SUR bivariate probit selection models, we added those variables that, based on the identification tests reported in appendix 4.B, were found passible in the treatment-effect analyses of the wage rates for college and university graduates respectively. Here, we restrict our discussion to the main parameters of interest⁹: the δ parameter and the ρ parameters in the various models.

We start our discussion with the college graduates as reported in the upper part of Table 4.4. The first line repeats the result from Table 4.2 and shows the effect of mobility on wages for the complete sample of college graduates. Below this, the results of individual estimations for the college graduates in economics and in healthcare, and by gender, are shown. For economics college graduates, the wage premium is insignificant in the OLS model, and significantly negative in the treatment-effects model, when using the same control variables as before. This means that

⁹ The models discussed in this section include the same controls as the models for wage rate in Section 4.4.1. The full specifications are detailed in Appendix 4.A.

college graduates in economics who found a job at a large distance were disadvantaged. It is possible that forced migration as a result of labour queue effects could play a role in this finding: the reason could be informational disadvantages, both for employers on the competences of graduates from colleges further away, as well as for graduates on the ‘local’ labour situation. Parameter ρ is statistically significant and positive, indicating that positive self-selection also plays a part. These opposing signals suggest that, given the controls present in our models, there must be distinct sub-groups of economics graduates. Some manage to achieve a good match regardless of whether they move or not, whereas others appear to be encountering issues related to forced migration or are moving for reasons not primarily related to job-match quality. Conversely, for college graduates in healthcare, migration after graduation has no influence on the wage equations of the two models with the controls we have included in the models. Turning to the gender issue, we have only found a positive effect of migration on male college graduates in the OLS specification. We find no effects on the wage rate from migration, for either men or women, after controlling for selectivity. We do however find evidence of positive selection for both men and women, which could indicate that those with a high mobility propensity achieve a wage premium, regardless of whether they actually move or not.

Now, we turn to the university graduates. For those graduating in economics, migration is beneficial according to the OLS model, whereas the effect is insignificant in the treatment-effects model. As such, the returns on migration can be seen as being fully captured by human capital and the other factors that are included in the selection and outcome equations for this group, resulting in no additional effect from spatial mobility as such. For university healthcare graduates, migration has no effect, a result in line with our results for college graduates.

We find positive effects gained from migration for both male and female university graduates. Comparing male and female university graduates using the baseline OLS models, we see that the δ parameter is slightly higher for women. Even though this does not provide a direct test of the differences in returns on spatial mobility between men and women, this primary OLS result is in line with the expectations voiced earlier. However, after controlling for self-selection, the δ parameters for both men and women become insignificant. For women, we find a positive selection effect, which suggests that the higher wage premium for women results from individual unobserved factors that lead to both a greater tendency to be spatially mobile as well as a better wage rate.

With the exception of the results for healthcare graduates from both college and university, these results are not in line with our expectations. Despite their greater mobility, we find no effect on wages for women after controlling for selection, let

alone a greater effect than that found for males. However, we have found consistent positive selection effects for women, indicating that it is not the move as such, but other unobserved factors that account for the way women compensate for any disadvantages experienced in local labour markets. The negative effect of migration for economics college graduates could perhaps be explained by the role that colleges of higher education play in local economies. Graduates that move, perhaps do so in response to finding themselves in an adverse position in the local labour queue.

We now turn to the alternative job-match measures for college graduates. In the “naïve” probit equations, the impacts of mobility on getting a full-time job and a job commensurate with one’s education level are positive. Conversely, we find a negative effect of mobility on the probability that a college graduate has a permanent job. However, after controlling for the correlation that may exist between the propensity to be mobile and the quality of the job-match in the seemingly unrelated bivariate probit model, the δ coefficients decrease and in some cases become more negative. Forced migration has negative effects on the job-match in terms of the field of work and the probability that one is not looking for another job. Also we find a stronger negative effect on the likelihood of finding a permanent job. A positive selection effect is found for having a full-time job, a good match in terms of field of work and the likelihood of not looking for another job. In terms of the latter two, this is opposite to the negative effect found for δ . Again this could be an indication that various matching processes are in play at the same time. Negative effects of constrained migration (a significant negative effect for ρ) do not seem to play a role for college graduates.

The picture that emerges for these other job-match aspects is clearer with university graduates. Even more so than for the college graduates, the estimated coefficients for the relationships between spatial mobility and the proposed alternative outcomes are generally positive and significant in the probit models that do not take selection into account (the exception being for match with field of work, where we find a significant negative effect). As such, university graduates seem to improve their labour position by being geographically mobile. The ρ indicator is insignificant for all the job-match aspects. However, after controlling for selection, the effect of being relatively mobile on the likelihood of finding a permanent job, a job at a commensurate level and a job that is regarded a good match by the graduate becomes insignificant. The δ parameters for “finding a full-time job” and “not looking for another job” remain positive and significant in the bivariate probit models, with increases in effect size. Even though ρ is not significant, it does appear that negative selection plays a minor role here, with some facing negative consequences from constraints on migration that give the δ parameter a downward bias in the naïve probit model. University graduates generally see improvements in these job-match aspects if

they are spatially mobile. Finally, the effect of migration on matching the field of work remains negative, and even becomes stronger.

4.5 Discussion and conclusions

In this chapter we have studied the relationship between spatial mobility and the job-match quality for a sample of young Dutch recent graduates. The inflow of graduates to regions is often considered an important asset in achieving regional growth. Such benefits are more likely to come to fruition when these graduates are able to achieve a successful match on the regional labour market such that they can fully exploit the investment in their human capital. Looking at this specific group allows us to abstract the confounding issues that have been noted in the literature, such as the relation between job-to-job mobility and spatial migration, and their effects on job-match quality. At the same time, we aim to add to the literature by looking at a number of additional job-match indicators, alongside the more commonplace hourly wage rate. In our analysis, we include a rich variety of observed human capital indicators, as well as controlling for unobserved personal characteristics that may introduce endogeneity into the relationship between migration and job-match quality.

Our primary OLS multivariate analysis of mobility and wages showed that spatial mobility, both for college and university graduates, has the anticipated significant positive effect on wages, a finding in line with many other studies. Alongside this, a number of observable human capital indicators, plus regional circumstances such as the prevailing labour market conditions, have strong and consistent effects on wage rates.

However, after controlling for self-selection, we find that the positive effects of spatial mobility on the hourly wage rate are no longer significant for university graduates, and even become negative for college graduates. Whereas economic theory predicts positive returns on migration, our results seem to indicate that a variety of personal and regional factors are key to achieving this benefit, not the move as such. These factors include observed characteristics such as graduation grades, participation in extracurricular activities and the scale of the labour market one is moving into. Having taken these aspects into account, we are left with migration having a negative effect on college graduates, a result that is somewhat counterintuitive. The implication is that forced migration, or migration for reasons unrelated to the job-match as such, may play a role. We also see some evidence for positive selection among college and university graduates. That is, those that have a higher propensity to be mobile are also the more likely to do well in terms of wage rate, for reasons beyond those included in our set of exogenous variables.

We have further analysed this relationship for a number of specific sub-groups in our sample: graduates in the fields of economics and of healthcare, and men and women. Here too, the initially positive effects from migration on wage rate for university economics graduates, and for men and women are rendered insignificant after controlling for self-selection. Moreover, for college economics graduates, we find significant negative effects of migration on wage rate. For university economists and male university graduates in general, the positive returns on migration seem to be fully driven by the observed human capital and other characteristics. Spatial mobility does not seem to enhance the wages of college and university healthcare graduates, a finding which is perhaps related to the spread of employment opportunities for this group. We have demonstrated that the wage effects for male and female college graduates and for female university graduates can be reduced to a positive selection effect, indicating that the favourable effects of migration for these groups are also related to unobserved individual characteristics. This was not in line with our expectations, especially for female graduates since spatial mobility is often regarded as a means for this particular group to deal with adverse circumstances in local labour markets.

In this study, we have also analysed the relationship between spatial mobility and a number of alternative job-match indicators that relate to objective characteristics of the contract such as hours worked, the length of the contract and the horizontal and vertical matching, as well as more-subjective evaluations of the match between education and job.

Even though the evidence is slightly more mixed than for wages, we again find that controlling for selectivity generally reduces the observed returns on migration. For some job-match indicators, the initially already negative returns on migration, found using the ordinary probit equations, became more strongly negative in the bivariate probit models. In other cases, a relationship that was initially positive became insignificant after controlling for self-selection. We found evidence that some aspects of job match (i.e. having a permanent contract and, for college graduates, not looking for another job) and field match (for both university and college graduates) are affected negatively by forced migration, or by migration that is driven by motivations not directly related with labour market outcomes, such as household situation or amenities in the destination region. Conversely, for university graduates, we do find positive effects of migration on the likelihood of finding a full-time job. Also, university graduates that are relatively mobile are less likely to be looking for another job. These were the only two job-match aspects for which we found that the likelihood of a successful outcome increased after controlling for selection. This implies that a degree of negative selection, leading to a downward bias of the migration dummy in

the ordinary probits, plays a role in these situations. One interpretation is that there are negative effects, resulting from constraints to mobility, on these specific elements of the job-match quality for those university graduates with a relatively high propensity to be mobile.

This study demonstrates that, in general, the returns on spatial mobility are not driven by the move as such, but by other personal and regional characteristics. It also suggests that the job-matching process after completing education may be heterogeneous. For example, the probability that a college graduate is looking for another job is affected by selection as well as a remaining effect of migration, in opposing directions. This could be an indication that, within our sample, different sub-groups are affected in different ways.

In terms of policy, this leads to the conclusion that generic labour market measures, especially in less opportunity-rich labour markets, are likely to be of limited efficacy. There are specific groups of graduates that fail to find a local match and are therefore forced to move to other regions with, at least initially, a poor match as a consequence. This appears to most notably affect college graduates, especially in terms of fixed contracts, jobs in the right field and general job satisfaction. Targeting labour market information at this group could prove fruitful. Also, constraints on migration may lead to unfavourable outcomes for university graduates (in terms of getting a full-time job and in terms of general job satisfaction). However, the more able, and perhaps more intrinsically motivated, tend to find their way regardless. Policymakers in regions that offer limited opportunities for graduates from local institutions of higher education may be worried that the high returns achievable through migration are indicative of wide structural problems in their own labour markets. However, as this study has demonstrated, these returns on migration do not in general result from the move as such.

A fruitful avenue for further research could be to include household and partner characteristics and also characteristics that are not directly related to labour market entry. These could serve to explain some of the unobserved constraints on migration, or provide rationales for moves that are unexpected from a pure labour market/career perspective.

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References

- Abreu, M.A., Faggian, A. and McCann, P. (2010) Migration and inter-industry mobility of UK graduates: effect on earnings and career satisfaction. *MICRO-DYN Working paper series*, 47/10.
- Axelsson, R. and Westerlund O. (1998) A panel study of migration, self-selection and household real income. *Journal of Population Economics*, 11 (1), 113-126.
- Berry, C.R. and Glaeser, E.L. (2005) The divergence of human capital levels across cities. *Papers in Regional Science*, 83 (3), 407-444.
- Borjas, G.J. (1987) Self-Selection and the earnings of immigrants. *The American Economic Review*, 77 (4), 531-553.
- Borjas, G.J., Bronars, S.G. and Trejo S.J. (1992) Self-selection and internal migration in the United States. *Journal of Urban Economics*, 32 (2), 159-185
- Büchel, F. and Van Ham, M. (2003) Overeducation, regional labor markets, and spatial flexibility. *Journal of Urban Economics*, 53 (3), 482-493.
- Cörvers, F., Hensen, M.M. and Bongaerts, D. (2009) Delimitation and coherence of functional and administrative regions. *Regional Studies*, 43 (1), 19-31.
- Dahl, G.B. (2002) Mobility and the return to education: Testing a Roy model with multiple markets. *Econometrica*, 70 (6), 2367-2420.
- DaVanzo, J. and Morrison, P.A. (1981) Return and other sequences of migration in the United States. *Demography* 18 (1), 85-101.
- Détang-Dessendre, C., Drapier, C. and Jayet, H. (2004) The impact of migration on wages: empirical evidence from French youth. *Journal of Regional Science*, 44 (4), 661-691.
- Dostie, B. and Léger, P.T. (2009) Self-selection in migration and returns to unobservables. *Journal of Population Economics*, 22 (4), 1005-1024.
- Eliasson, K. (2011) Migration and labor market outcomes among recent college graduates: Swedish evidence. *Conference of the Western Regional Science Association*, Februari 2011, Monterey, CA, U.S.A.
- Faggian, A. and McCann, P. (2006) Human capital flows and regional knowledge assets: a simultaneous equation approach. *Oxford Economic Papers*, 58 (3), 475-500.
- Faggian, A., McCann, P. and Sheppard, S. (2007) Some evidence that women are more mobile than men: gender differences in U.K. graduate migration behavior. *Journal of Regional Science*, 47 (3), 517-539.
- Gabriel, P.E. and Schmitz, S. (1995) Favorable self-selection and the internal migration of young white males in the United States. *The Journal of Human Resources*, 30 (3), 460-471.
- Graves, P.E. and Linneman, P. (1979) Household migration: Theoretical and empirical results. *Journal of Urban Economics*, 6 (3), 383-404.
- Hensen, M.M., De Vries, R.M. and Cörvers, F. (2009) The role of geographic mobility in reducing education-job mismatches in The Netherlands. *Papers in Regional Science*, 88 (3), 667-683.

- Herzog Jr., H.W., Hofler, R.A. and Schlottmann, A.M. (1985) Life on the frontier: Migrant information, earnings and past mobility. *The Review of Economics and Statistics*, 67 (3), 373-382.
- Herzog Jr., H.W., Schlottmann, A.M. and Boehm, T.P. (1993) Migration as spatial job-search: A survey of empirical findings. *Regional Studies*, 27 (4), 327-340.
- Hunt, J. (2004) Are migrants more skilled than non-migrants? Repeat, return, and same-employer migrants. *Canadian Journal of Economics*, 37 (4), 830-849.
- Krieg, R.G. (1997) Occupational change, employer change, internal migration, and earnings. *Regional Science and Urban Economics*, 27 (1), 1-15.
- Lehmer, F. and Ludsteck, J. (2011) The returns to job mobility and inter-regional migration: evidence from Germany. *Papers in Regional Science*, 90 (3), 549-571.
- Van Leuvensteijn, M. and Koning, P. (2004) The effect of home-ownership on labor mobility in The Netherlands. *Journal of Urban Economics*, 55 (3), 580-596.
- Maddala, G.S. (1983) *Limited-dependent and qualitative variables in econometrics*. Cambridge: Cambridge University Press.
- Nakosteen, R.A. and Westerlund, O. (2004) The effects of regional migration on gross income of labour in Sweden. *Papers in Regional Science*, 83 (3), 581-595.
- Nakosteen, R.A., Westerlund, O. and Zimmer, M.A., (2008) Migration and self-selection: measured earnings and latent characteristics. *Journal of Regional Science*, 48 (4), 769-788.
- Newbold, K.B. (2001) Counting migrants and migrations: Comparing lifetime and fixed-interval return and onward migration. *Economic Geography*, 77 (1), 23-40.
- Pissarides, C.A. and Wadsworth, J. (1989) Unemployment and the inter-regional mobility of labour. *The Economic Journal*, 99 (397), 739-755.
- Roy, A.D. (1951) Some thoughts on the distribution of earnings. *Oxford Economic Papers, New Series*, 3 (2), 135-146.
- Scott, A.J. (2010) Space-time variations of human capital assets across U.S. metropolitan areas, 1980 to 2000. *Economic Geography*, 86 (3), 233-250.
- Sjaastad, L.A. (1962) The costs and returns of human migration. *The Journal of Political Economy*, 70 (5, Part 2: Investment in Human Beings.), 80-93.
- Smits, J. (2001) Career migration, self-selection and the earnings of married men and women in The Netherlands, 1981-93. *Urban Studies*, 38 (3), 541-562.
- Thurow, L.C. (1975) *Generating inequality*. New York, Basic Books Inc.
- Van der Klaauw, B. and Van Vuuren, A. (2010) Job search and academic achievement. *European Economic Review*, 54 (2), 294-316.
- Venhorst, V.A., Van Dijk, J. and Van Wissen, L.J.G. (2010) Do the best graduates leave the peripheral areas of The Netherlands? *Tijdschrift voor Economische en Sociale Geografie*, 101 (5), 521-537.
- Venhorst, V.A., Van Dijk, J. and Van Wissen, L.J.G. (2011) An analysis of trends in spatial mobility of Dutch graduates. *Spatial Economic Analysis*, 6 (1), 57-82.
- Yankow, J.J. (2003) Migration, job change, and wage growth: a new perspective on the pecuniary return to geographic mobility. *Journal of Regional Science*, 43 (3), 483-516.

Appendix 4.A: full estimation results from treatment-effects regression for sub-groups and SUR bivariate probit models

In Tables 4.A.1 through to 4.A.4 we present the estimation results for the wage analyses for specific groups, based on academic discipline and gender, and the estimation results for the alternative job-match measures applied in this study. With the analyses of $\ln(\text{HourlyWage})$ for the various sub-samples (economists, healthcare graduates, women, men) in Tables 4.A.1 (college) and 4.A.3 (university) we report only the results for the treatment-effects regressions, i.e. the selection equation (probit) and the outcome equation (linear). The coefficients in the ‘naïve’ OLS regressions are almost identical to those for the outcome equations in the treatment-effects framework and are therefore omitted to save space. The OLS coefficient for migration was reported in Table 4.4 and not repeated here.

In reporting our analysis of the alternative job-match measures, using the SUR bivariate probit model, in Tables 4.A.2 and 4.A.4, we include only the outcome equations. These analyses were all performed on the overall sample. Consequently, the selection equation results are the same for all these models and are therefore only included once: in the first columns of Table 4.A.2 (college graduates) and Table 4.A.4 (university graduates). To save space, the results relating to the dummy controls for field of study and for time were omitted from all the tables. These are available from the authors upon request.

Table 4.A.1: Treatment-effects regressions: college graduates (various samples).

	Economics grads			Healthcare grads			Women			Males		
	Treatment effects regression Selection	LN(Hourly Wage)	Outcome	Treatment effects regression Selection	LN(Hourly Wage)	Outcome	Treatment effects regression Selection	LN(Hourly Wage)	Outcome	Treatment effects regression Selection	LN(Hourly Wage)	Outcome
<i>Spatial mobility</i>												
Rel. mobile study to job loc (δ)		-0.037**	0.025									
ρ		0.142***	-0.081									
<i>Demographics</i>												
Male												
Age	0.065*	0.062***	0.096***	0.048			0.229			-0.148		0.003
Age Squared	-0.053	0.056	0.062	0.549			-0.494			0.308		0.027
Foreign born EU	0.056	-0.073	-0.090	-1.040			-0.087			0.279		0.014
Foreign born Non-EU	0.071	0.032	0.039	0.013			0.021			0.167		-0.007
<i>Human Capital</i>												
Low grade [6,7>	-0.018	-0.039***	-0.010	0.105			0.057			-0.016		-0.037***
High grade [8,10]	0.106**	0.035***	-0.005	-0.114			0.002			0.038		0.025***
Study duration in months	0.038	0.087***	-0.046	-0.228			0.368**			-0.190		0.016
Relevant work exp	0.066*	0.012*	-0.003	-0.077			0.004			-0.027		0.018***
Management exp	-0.022	0.019***	0.007	0.074			-0.061			0.016		0.007
Study abroad	0.149**	0.002	0.003	-0.160			0.044			0.010		-0.003
Internship abroad	0.153***	-0.022***	-0.022	-0.017			0.057			0.182***		-0.001
Follow-on education	-0.067	0.013	-0.026	0.073			-0.018			0.000		0.006
<i>Transition study - job</i>												
Duration finals - questionnaire	0.282	0.540***	0.342*	-1.018			-0.277			0.483		0.333***
Months unemployed	-0.337	-1.388***	-0.329	-0.243			0.924			1.385*		-0.903***
<i>Regional economic characteristics</i>												
# suitable jobs dest t-1	-0.573***	0.137***	0.160***	0.543			-0.238			-0.055		0.133***
mean housing value dest t-1	0.224***	0.014***	-0.001	0.069*			0.120***			0.199***		0.013***
reg econ growthrate dest t-1	-0.049**	-0.003	0.002	0.055			-0.037***			-0.083***		-0.004
reg unempl rate grads dest t-1	0.193***	0.008**	-0.001	-0.016			0.074***			0.076***		0.005*
<i>Time and field of study dummies</i>												
Time Dummies	YES	YES	YES	YES			YES			YES		YES
Field of Study Dummies	NO	NO	NO	NO			YES			YES		YES
<i>Additional controls</i>												
Lived in Core at age 16	-0.092**			-0.402***			-0.172***			-0.050		
Parent(s) foreign born	0.077	0.025**		0.106			0.045			0.100*		
Rel. mobile home to study loc	0.486***			0.457***			0.494***			0.484***		
Constant	-1.111	1.342**	1.538*	-7.780			-3.997*			0.423		2.162***
		724.319	104.478							549.846		489.844
		5561	1659							9180		6943

CHI 2

N

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4.A.2: SUR Bivariate probit models: college graduates (various job match indicators).

	Selection eq. results		SUR Bivariate Probit				Outcome eq. results	
	RelMob StJob	Perman Cont	FullTime	Level Match	Field Match	GoodMatch Subj	NotLooking OthJob	
<i>Spatial mobility</i>								
Rel. mobile study to job loc (δ)		-0.131** 0.054	-0.050 0.106**	0.017 0.070	-0.416*** 0.274***	-0.033 0.039	-0.274*** 0.162***	
<i>Demographics</i>								
Male	0.040	0.233***	0.388***	0.213***	0.096***	0.095***	0.196***	
Age	0.012	0.035	0.381***	0.039	0.058	0.062	-0.300**	
Age Squared	-0.036	-0.104	-0.766***	-0.082	-0.181	-0.175	0.510*	
Foreign born EU	0.040	-0.042	0.127	0.204	0.232*	-0.034	-0.065	
Foreign born Non-EU	0.083	-0.134*	0.043	0.030	0.025	0.003	-0.013	
<i>Human Capital</i>								
Low grade [6,7>	0.018	-0.056*	0.034	-0.218***	-0.127***	-0.154***	-0.104***	
High grade [8,10]	0.015	0.057**	0.013	0.142***	0.012	0.062**	0.093***	
Study duration in months	0.095	-0.040	-0.605***	-0.157	-0.558***	-0.305***	-0.403***	
Relevant work exp	-0.009	0.042**	-0.063**	-0.005	0.067***	0.106***	0.009	
Management exp	-0.015	0.039	0.004	0.130***	-0.048	0.049*	0.022	
Study abroad	0.037	-0.038	0.023	0.100*	-0.142***	-0.073	-0.032	
Internship abroad	0.105***	-0.025	0.074**	-0.063*	-0.056*	-0.022	-0.037	
Follow-on education	-0.011	-0.331***	-0.372***	0.042	-0.077**	-0.106***	0.007	
<i>Transition study - job</i>								
Duration finals - questionnaire	0.114	3.502***	1.091***	0.445	-0.349	-0.003	0.261	
Months unemployed	1.073**	-8.571***	-4.499***	-3.578***	-3.096***	-4.690***	-5.689***	
<i>Regional economic characteristics</i>								
# suitable jobs dest t-1	-0.164	0.660***	0.173*	0.276***	-0.032	-0.150	0.211**	
mean housing value dest t-1	0.155***	0.065***	0.002	-0.001	0.014	0.025**	0.055**	
reg econ growthrate dest t-1	-0.057***	-0.006	0.025*	-0.004	0.026*	0.010	-0.005	
reg unempl rate grads dest t-1	0.074***	0.007	-0.052***	0.020	0.004	-0.003	-0.011	
<i>Time and field of study dummies</i>								
Time Dummies	YES	YES	YES	YES	YES	YES	YES	
Field of study Dummies	YES	YES	YES	YES	YES	YES	YES	
<i>Additional controls</i>								
Lived in Core at age 16	-0.124***							
Parent(s) foreign born	0.072*							
Rel. mobile home to study loc	0.491***							
Constant	-1.421	-0.942	-4.511**	-0.237	1.189	0.429	5.254***	
		16123	16123	16123	16123	16123	16123	
		-19600	-16000	-16000	-16100	-17700	-16000	
		1998.967	4885.305	2055.205	2764.997	1618.037	1782.298	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

N
Log Likelihood
CHI 2

Table 4.A.4: SUR Bivariate probit models: university graduates (various job match indicators).

	Selection eq. results		SUR Bivariate Probit				Outcome eq. results		NotLooking OthJob
	RelMob StJob	Perman Cont	Full Time	Level Match	Field Match	GoodMatch Subj			
<i>Spatial mobility</i>									
Rel. mobile study to job loc (δ)		-0.024	0.350*	0.007	-0.354**	0.171	0.325*		
ρ		0.058	-0.142	0.095	0.166	-0.029	-0.133		
<i>Demographics</i>									
Male	-0.016	0.184***	0.408***	0.120***	0.019	0.074**	0.137***		
Age	0.634***	0.640***	1.059***	0.237	0.467**	0.699***	0.450*		
Age Squared	-1.187***	-1.205***	-2.023***	-0.477	-0.921**	-1.347***	-0.929***		
Foreign born EU	-0.185	0.109	-0.102	0.063	-0.113	-0.199	-0.090		
Foreign born Non-EU	-0.063	-0.148	-0.053	0.261**	0.027	-0.213**	-0.069		
<i>Human Capital</i>									
Low grade [6,7>	-0.014	-0.029	0.084	-0.262***	-0.117**	-0.215***	-0.045		
High grade [8,10]	0.043	-0.058*	-0.111***	0.305***	0.034	0.124***	0.009		
Study duration in months	-0.121*	-0.105*	-0.426***	0.054	-0.379***	-0.278***	-0.196***		
Internship	0.025	-0.017	-0.147***	0.234***	0.098***	0.124***	0.043		
Relevant work exp	0.019	0.069**	-0.073**	0.180***	0.215***	0.227***	0.031		
Management exp	0.091***	0.043	0.154***	0.214***	-0.143***	0.086**	0.093**		
Study abroad	0.008	-0.075*	0.228***	0.136***	-0.091**	0.064	0.053		
Internship abroad	0.089**	-0.017	0.211***	0.283***	-0.051	0.064	-0.046		
Follow-on education	-0.117**	-0.243***	-0.265***	0.192***	0.102*	0.042	0.154***		
<i>Transition study - job</i>									
Duration finals - questionnaire	0.971**	3.337***	1.024**	-0.360	0.653	-0.189	0.315		
Months unemployed	0.241	-7.492***	-2.100***	-2.051***	-0.894	-3.407***	-2.389***		
<i>Regional economic characteristics</i>									
# suitable jobs dest t-1	-0.327**	0.338**	0.501***	0.706***	-0.519***	0.071	0.511***		
mean housing value dest t-1	-0.259***	0.051**	-0.003	-0.067***	-0.080***	-0.027	0.006		
reg econ growthrate dest t-1	0.194***	0.010	0.023	0.006	0.098***	-0.020	-0.042		
reg unempl rate grads dest t-1	-0.057***	-0.023	-0.037**	0.012	-0.055***	-0.008	-0.011		
<i>Time and field of study dummies</i>									
Time Dummies	YES	YES	YES	YES	YES	YES	YES		
Field of Study Dummies	YES	YES	YES	YES	YES	YES	YES		
<i>Additional controls</i>									
Lived in Core at age 16	-0.158***	0.021	-0.134***	0.016	-0.005	0.029	0.003		
Parent(s) foreign born	-0.048								
Rel. mobile home to study loc	0.298***								
Constant	-8.816***	-9.150***	-13.469***	-3.474	-4.925*	-8.662***	-4.963		
		8531	8531	8531	8531	8531	8531		
		-10500	-8381	-10300	-9866	-9448	-8897		
		1542.658	1941.132	1702.915	1262.357	1354.379	1093.020		
N									
Log Likelihood									
CHI 2									

N
Log Likelihood
CHI 2

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix 4.B: identification tests.

Table 4.B.1: Results for identification tests.

Sample	Dependent variable outcome eq.	Parent(s) foreign born	Rel. mobile home to study loc	Lived in Core at age 16	Over-identification test of all instruments		Under-identification test		Weak identification test
					Hansen J statistic	sig	Kleibergen- Paap rk LM statistic	sig	
College									
Total	LN(HourlyWage)	SEL	SEL	SEL	2.722	0.256	1378.570	0.000	461.756
Economics grads	LN(HourlyWage)	SEL & OUTC	SEL	SEL	0.409	0.522	430.568	0.000	228.906
Healthcare grads	LN(HourlyWage)	SEL	SEL	SEL	0.244	0.885	156.490	0.000	42.821
Women	LN(HourlyWage)	SEL & OUTC	SEL	SEL	2.406	0.121	893.104	0.000	383.591
Men	LN(HourlyWage)	SEL	SEL	SEL	0.387	0.824	483.133	0.000	210.493
University									
Total	LN(HourlyWage)	SEL	SEL	SEL & OUTC	1.115	0.291	212.427	0.000	116.412
Economics grads	LN(HourlyWage)	SEL	SEL	SEL & OUTC	2.497	0.114	18.519	0.000	8.404
Healthcare grads	LN(HourlyWage)	SEL	SEL	SEL	2.065	0.356	50.607	0.000	23.729
Women	LN(HourlyWage)	SEL & OUTC	SEL	SEL	0.061	0.804	158.368	0.000	85.241
Men	LN(HourlyWage)	SEL	SEL	SEL & OUTC	2.159	0.142	71.547	0.000	39.028

5. Human capital spillovers in Dutch cities: consumption or productivity?

ABSTRACT¹⁰- In this chapter, we study the recursive relationship between the ability of Dutch cities to attract graduate human capital to their housing and labour markets and a city's skills structure, using a comprehensive dataset. Controlling for the effects of characteristics of other relevant cities and a city's skills endowment, we find positive effects of a relatively strong graduate labour market inflow on the share of scientific-level jobs. Next to this, graduate inflows to residential areas have positive effects on the share of jobs requiring lower and medium skills. We find only limited evidence for both production and consumption spillovers across skill levels at this spatial level of analysis. Generally, only the localisation of one's own skills group matters.

Keywords: city skill structure, human capital spillovers, housing market, labour market, recent graduates

5.1 Introduction

The presence of human capital in regions and cities is widely regarded as conducive to development and economic growth. Highly skilled individuals, using the urban density to share knowledge and to learn, promote productivity increases (Lucas, 1988, Krugman, 1991). Potentially, cooperating and sharing the city market place with such highly skilled individuals has beneficial effects for other skills groups. These benefits may materialise through production and consumption spillovers. Production spillovers occur when complementarities are sufficiently strong, such that an increase in demand for highly skilled workers also leads to an increase in opportunities for less-skilled

¹⁰ Chapter based on: Venhorst, V.A. (2011) Human capital spillovers in Dutch cities: consumption or productivity? 51st WRSA Conference, February 8 – 11 2012, Kauai, Lihue, Hawaii, United States of America.

employees. It has been shown that lower skilled workers benefit from learning in dense urban environments (Glaeser, 1999, Jovanovic and Rob, 1989). Further, a growth in low-skilled services, as a result of consumption spillovers, has been related to the presence of a highly educated incumbent population (Sassen, 2001). Through such mechanisms, the presence of highly skilled individuals in cities may boost opportunities for all skills groups.

There is a strong focus among local policymakers on attracting and retaining graduate human capital (see Venhorst *et al.*, 2011b for an overview), with the aim of capturing these benefits for the regional economy. However, there is little knowledge on how this affects a city's skills structure in the longer term. Does the presence and inflow of highly skilled workers and inhabitants create or reduce the opportunities for only such highly skilled groups; or are there also effects on other skills groups? What is the most important mechanism that drives these effects: productivity or consumption spillovers? Should policymakers focus on retaining or attracting graduates to the local labour market, or is there also a role for the residential market? In this chapter, we study the structural determinants of the skills structure of Dutch cities. We focus specifically on the interaction between the employment skills structure and the inflow of graduate human capital. We apply a unique dataset that allows us to control for the existing city stocks of human capital and other factors that may influence the city's skills structure.

In order to address both production and consumption spillovers, graduate human capital inflow is operationalised in terms of labour market inflow relative to housing market inflow. Our dataset allows us to distinguish between graduates starting a career within a city's labour market and graduates moving into the city's residential areas. Further, an important feature of this study is our differentiation between the exact location of jobs and the location of the resident population. This will be instrumental in disentangling consumption and productivity effects of existing stocks of resident and working individuals with high human capitals in cities.

Secondly, our data allow us to distinguish between the education level of workers in jobs located within the city and the skills level required by employers for those jobs. The latter may be a better measure of a city's skills structure as workers with long tenures tend to progress to higher level jobs through on-the-job learning or additional training (Schlitte, 2010) than their initial education level would suggest. As such, this approach allows us to look at how skills are utilised.

Thirdly, little is known about how a city's skills structure is related to the characteristics of other nearby cities, or those with which a commuting tie exists. This is particularly important when studying employment and population interactions on

lower spatial scales. Since cities can be regarded as perfect open economies (Nijkamp and Poot, 1998), it is important to take into account the effects of nearby areas. For example, it has been demonstrated that nearby large cities can create substantial backwash effects (Partridge *et al.*, 2007a, b) and that nearby residential amenities may have effects on a firm's location choice (Boarnet, 1994, Gottlieb, 1995).

This chapter is structured as follows. In Section 5.2, we discuss the main findings that have emerged from the literature. This is followed by a discussion on the approach taken in this study. In Section 5.3, we introduce our dataset covering 293 Dutch municipalities and discuss the operationalisation of our variables. In Section 5.4, we discuss the results from our empirical analysis and Section 5.5 presents the main conclusions.

5.2 Literature review and approach

5.2.1 Human capital and regional economic development

It is widely recognised in the literature that, in addition to private benefits from human capital accruing to individual workers, there are social benefits to having a sizeable pool of individuals with high human capitals within a region (Lucas, 1988, Rauch, 1991). It is argued that the beneficial effects of human capital are higher in dense economic environments such as cities because face-to-face interactions between individuals are less costly and happen more frequently. Such interactions speed the transmission of new ideas and knowledge in a regional economy. An overview of the theoretical work on the mechanism involved can be found in Duranton and Puga (2004). Moretti (2004a) gives an overview of empirical research on these human capital spillovers. Essentially, as workers become more productive in these urban environments, higher net wages will be paid by firms, thus attracting more workers. City land rents then increase to the point where an individual migrant faces the same real wage level across the economy, thereby bringing migration towards the city to a halt (Moretti, 2004b). Through this process, the externality of human capital is internalised within the economy.

Human capital spillover is the mechanism through which the human capital stock exerts its effect on the economy. Assuming the process of internalisation described above, spillovers are often studied through the development of individual wages and land rent premiums in relation to regional aggregate human capital levels, using Mincerian frameworks (Rauch, 1991, Acemoglu and Angrist, 2000, Moretti, 2004a, 2004c, Glaeser and Mare, 2001, Shapiro, 2006). The wage effect of a relatively large supply of highly skilled workers consists of two components: a supply effect and

a spillover effect. If complementarities between skill levels in the labour market are sufficiently high, and substitution between the skill levels is low, an oversupply of highly skilled workers will lead to lower wages (through lower marginal productivity) for this group. Higher wages for the other skills groups within the local economy can be expected as a result of the high complementarities. The spillover also serves to increase general productivity, for example through learning in dense environments. Any empirically measured effect of a region's endowment of highly skilled inhabitants on skill-specific wage rates is therefore the sum of these two effects (Moretti, 2004b). The positive effects on wages from the presence of a large stock of highly educated workers, as are generally found in the literature, are an indication that the spillover effect is sufficient to overcome any negative supply effect. However, greater insight is needed into the underlying mechanism. Broersma and Edzes (2010) show, for example, that, for the Netherlands, an important component of the wage spillover effect results from interactions between individuals within firms rather than interactions between individuals co-located within a region.

Wage and land rent signals may however be distorted by institutional issues related to the functioning of labour and housing markets such as central wage bargaining and planning restrictions on real estate development. Central wage bargaining negates regional differences in productivity levels. Constraints on local real estate development make the responses of land rents to productivity shocks hard to identify. A number of studies have therefore focused specifically on the effect of human capital endowments on either skill-specific or overall employment growth¹¹.

Human capital spillovers do not necessarily translate into employment growth. Combes *et al.* (2004) point out that technological development may be labour saving, or that labour supply may be inelastic. Suedekum (2009) notes that the employment effects of human capital spillovers may be driven by complementarities between skills groups. Also, a relatively skill-abundant local economy may, as a result of the negative supply effect on wage rates, attract fewer additional highly skilled workers (Suedekum, 2009). A variety of studies have however demonstrated that high human capital endowments do have positive effects on subsequent city employment growth (Glaeser and Saiz, 2004, Suedekum, 2009, Glaeser *et al.*, 1995, Shapiro, 2006; for the Netherlands specifically see Marlet and Woerkens, 2007).

Other studies have focussed on the effects on different skills groups. For Germany, it was found that the presence of highly skilled workers has positive effects on the employment opportunities for medium and lower skilled workers (Suedekum,

¹¹ Among others, Blien *et al.* (2006), Glaeser *et al.* (1992) focus on city – industry employment growth. Their distinction between manufacturing and service-related sectors shows localisation effects similar to those found for human capital endowments elsewhere.

2009, Schlitte, 2010). Berry and Glaeser (2005) however note an increasing accumulation of skilled workers in U.S. metropolitan areas that are already well endowed with highly skilled inhabitants. Accumulation, or specialisation, in this context is studied by looking at the coefficient value of the lagged dependent variable in a model explaining levels or shares of human capital in cities. A value that is greater than one (the result in Berry and Glaeser, 2005) implies an increasing concentration over time, but is also indicative of an explosive time series. Poelhekke (2006) noted that these results therefore need to be interpreted with some care: the share of skilled individuals cannot increase indefinitely, something the analysis by Berry and Glaeser (2005) suggests. Nevertheless, it was demonstrated that, in the period studied (1970 – 2000), skilled U.S. cities became more skilled. This, however, was not due to the presence of skilled individuals as such. Rather, as Poelhekke (2006) concludes based on an analysis of the same Berry and Glaeser dataset, other city-specific factors seem to be in play.

Shapiro (2006) also notes that a positive relationship between human capital and city growth may be driven by other factors that affect both, such as amenities or the city's industry structure. Glaeser (2001) has pointed out that cities with high endowments of amenities have grown faster than low-amenity cities. He notes that urban rents have increased faster than wages, suggesting that the desire to live in urban areas has increased for reasons beyond productivity increases. Poelhekke (2006) highlights the importance, as a pull factor in the localisation of skills, of the low-skilled service sector. Bils and Klenow (2000) find a positive relationship between educational level and economic growth at the country level, but suggest that causality might in fact run the other way: that economic growth causes an increase in the average regional education level.

Spatial mobility may be a crucial factor in this respect. It has been demonstrated that regional human capital endowments can stimulate growth, as was discussed above. However, equally, human capital has been shown to flow to regions that are doing well (Duranton and Puga, 2004, Faggian and McCann, 2006, 2008, 2009, Carlino and Mills, 1987). This spatial mobility of human capital has consequences for its relationship with regional economic development since structural outflows of human capital can negatively affect innovative capacity (Nijkamp and Poot, 1998, Faggian and McCann, 2009). Rodríguez-Pose and Vilalta-Bufí (2005) found that job satisfaction and migration measures contributed substantially to explaining regional GDP, over and above the more traditional measures of human capital endowments. Therefore, it seems that attention should be paid not just to existing endowments, but also to what attracts human capital to regions and whether

these highly skilled workers are then able to utilise their skills in the regional economy.

Population and regional employment growth are thus found to be strongly related: directly through supply effects and spillovers, but also indirectly as a result of the aforementioned city-specific attractions and amenities. One line of literature has sought to more explicitly take these interrelationships into account, starting with Carlino and Mills (1987)¹². Following this approach, Boarnet (1994), Boarnet *et al.* (2005) and Gottlieb (1995) among others have pointed to the role that neighbouring areas play in employment and population growth. Boarnet (1994) highlighted spatial specialisation (working against living) in multi-centric metropolitan areas and finds that employment growth depends on the population growth in nearby residential areas. Gottlieb (1995) demonstrates that firms take the residential amenities in housing locations likely to be of interest to their staff into account in making location decisions, and that this extends to cities within commuting distance. Focussing on population growth, Partridge *et al.* (2007a, b) show that, for Canada, substantial, both positive and negative, effects may result from being close to larger metropolitan areas. In some cases, suburban areas are able to profit from providing residential opportunities for those working in the larger cities.

From this, we conclude that several factors are relevant in our study into the relationship between a city's skills structure and the inflow of graduate human capital. Firstly, not only existing stocks but also the flows of graduate human capital are important in explaining regional development. Reverse causality may play a role, with human capital being attracted to successful regions and cities. These two variables are therefore best treated as endogenous. Secondly, it is important to control for factors that may drive both the skills structure and the inflow of graduate human capital. An important insight is that aspects that can be thought of as purely residential amenities, may also affect the placement of employment. Thirdly, on the spatial scale of the Dutch city, we can expect strong interrelationships to exist between a city and other places, both close by and within commuting distances. In the next section we discuss how these matters were translated into our econometric approach.

5.2.2 Analysing the skills structure in Dutch cities: approach and hypotheses

In this study, we focus on the recursive relationship between a city's employment skills structure and the inflow of graduate human capital onto the city's labour and housing markets. Our analysis will be based on a sample of 293 Dutch cities, for which

¹² Hoogstra *et al.* (2005) provide an overview of studies based on this methodology. Hoogstra *et al.* (2010) present a Monte Carlo analysis of the effects of specification choices on the interrelationship between population and employment.

we have data spanning the period 1997 – 2008. In this section we outline our econometric approach. A discussion of our operationalisation and the dataset can be found in Section 5.3.

The main focus of our analysis is identifying the structural determinants of graduate inflow and a city's skills structure. Year-on-year changes in the skills structure of smaller cities can lead to quite substantial variation in growth rates, which leads to a rather volatile pattern of growth and decline, especially when looking at the relatively small skills categories of elementary and scientific-level jobs. Therefore, in this chapter, we analyse differences between cities, in terms of the spread of skills in total city employment and the inflows of human capital, rather than by considering annual growth rates.

In our modelling strategy, we have to be mindful of a number of potential econometric pitfalls. Firstly, the sought-after relationship is potentially obscured by issues of simultaneity and endogeneity. In a number of similar studies, simultaneity was dealt with by lagging the exogenous variables by a considerable length of time. Approaches in line with that of Carlino and Mills (1987) make explicit the interrelationship between population growth or composition (and its determinants) and employment by applying 2SLS or 3SLS techniques that account for covariation between population and employment. Similarly, we apply a two-equation 3SLS model; modelling 2008 outcomes for the endogenous city-specific skills structure and graduate inflow using exogenous variables lagged to 1998¹³. This has important consequences as it requires treating our data as a cross-section, which rules out using fixed effects or dynamic panel estimators such as the Arellano and Bond (1991) estimator which has often been applied in related work (for example Blien *et al.*, 2006). These panel-based fixed-effect approaches essentially reduce the analysis to the within estimator. That interpretation, which focuses on what changes within cities, rather than on identifying structural elements that differ between cities, is not in line with the main goals of our study. Nevertheless, we do enter the lagged dependent variable into our models. In line with Suedekum and Blien (2005), we apply weighted regression, using the city population share of the national total, to ensure that our results better reflect national patterns.

This results in a two-equation 3SLS model with the following specification. Firstly we have an equation that defines $JobSh_Sk_{s=i,t}$ - the share of total city employment at skill level S in city i at time t :

¹³ We have also analysed 2007 outcomes using independent variables lagged to 1997, and the results were qualitatively similar. The ten-year period applied in this study covers a full business cycle, with a strong recession in 2002 – 2003. It is also in line with studies for the USA that are often based on ten-year census intervals.

$$\text{JobSh_Sk}_{s=S,i,t} = \beta_1 \text{GrWork/Liv}_{i,t} + \beta_2 \text{WCGrWork/Liv}_{i,t-10} + \sum_s \zeta_s \text{JobSh_Sk}_{s,i,t-10} + X_{i,t-10} \theta + \varepsilon_{s,i,t}$$

with s indicating the skill levels required by employers in five categories $s = 1, \dots, 5$ (elementary, lower, medium, higher and scientific); i denotes the city index, $i = 1, \dots, 293$; and $t = 2008$ (the year). $\text{GrWork/Liv}_{i,t}$ denotes the endogenous key explanatory variable. It is computed as the ratio of the inflow of recent graduate human capital into the city's labour market to the inflow of recent graduate human capital into the city's residential area¹⁴. We also include a spatial lag of the endogenous variable ($\text{WCGrWork/Liv}_{i,t-10}$) following Boarnet (1994) and Boarnet *et al.* (2005)¹⁵. $\text{JobSh_Sk}_{s=S,i,t-10}$ denotes the lagged dependent variable which, along with the other skill levels $j \neq S$, is lagged to the base year of 1998. As we are interested in potential spillovers between skill levels, the stock of all five skill-levels are included in the model. A requirement is that $\sum_s \zeta_s = 0$ as, for a given city, the shares are mutually exclusive and must sum to 100%. As a result, the constant is suppressed in this equation. Matrix $X_{i,t-10}$ contains the other exogenous variables for city i , such as the education breakdown of the resident population (coefficients again must sum to zero), city size, labour and housing market characteristics plus spatially lagged values for a number of these variables. All the $X_{i,t-10}$ variables are lagged to the base year of 1998, as indicated by the subscript.

The second equation describes the endogenous variable $\text{GrWork/Liv}_{i,t}$, in which $\text{JobSh_Sk}_{s=S,i,t}$ is entered as an endogenous variable. The equation otherwise has a similar structure as the employment skills structure equation, including a lagged dependent variable, and a matrix $Z_{i,t-10}$ containing a set of additional exogenous variables:

$$\text{GrWork/Liv}_{i,t} = \gamma_0 + \gamma_1 \text{JobSh_Sk}_{s=S,i,t} + \gamma_2 \text{WCJobSh_Sk}_{s=S,i,t} + \gamma_3 \text{GrWork/Liv}_{i,t-10} + Z_{i,t-10} \xi + \eta_{s,i,t}$$

5.3 Operationalisation and data

In Appendix 5.A a full overview is presented of the variables applied in this study and the data sources used. Also, we discuss there the steps that were taken in constructing the main variables in our database in greater detail. Sample statistics for the main

¹⁴ We also ran our models using the natural logarithm of this variable as an endogenous regressor. The interpretation of the model coefficients changes slightly, as they then measure the effect on the log-difference between the flows of graduates, rather than the effect on the ratio between them. The results are however qualitatively the same.

¹⁵ We note here that Boarnet (1994) has a constraint $\beta_1 = \beta_2$. As an alternative, we treat the spatial lag of the endogenous variable (i.e. the unweighted mean of the variable over all cities with which a commuting relationship exists) as exogenous.

variables are reported in Table 5.1 below. We have focussed on a subset of 293 larger municipalities out of a national total of 441 (as of January 2009). Our selection was based on the number of inhabitants and data availability. Cities and towns with more than 10,000 inhabitants over the entire study period were selected. In our models, the exogenous variables¹⁶ (including the t-10 years of lagged values of the dependent variables) are entered using their 1998 values to prevent issues with simultaneity and endogeneity. For the endogenous variables we also provide the 2008 values in Table 5.1. For the sake of completeness, we have also included the descriptives for the employee shares by level of education in Appendix 5.B.

5.3.1 Endogenous variables

In this section, we discuss the two endogenous variables in this analysis: city skills structure and the inflow of graduates onto the city labour market or into the residential areas. Traditionally, measures of human capital are based on the highest education level attained, or the years of schooling completed. However, as Schlitte (2010), among others, has pointed out, this measure does not take into account the effects of on-the-job learning or increased responsibilities as a result of tenure. Alongside this, as DiPietro and Urwin (2006) point out, employers may increase the skills profile of their labour demands if skills are relatively abundant in their region, assuming that higher skilled employees will be easier to attract and can be trained at lower costs. The resulting patterns of over- and under- education mean that worker education level is not necessarily a good proxy for skill. As an alternative, the ‘International Standard Classification of Occupations’ (ISCO) job skills levels can be used as an indication of the skills structure of a local labour market. For the reasons outlined above, in this chapter, we base our analysis of the city skills structure (endogenous variable $JobSh_Sk_{s,i,t}$) on the ISCO classification, expecting it to better reflect the skills structure of the labour market. For comparison purposes, the results based on worker education levels are included in Appendix 5.B.

We now turn to our second endogenous variable, $GrWork/Liv_{i,t}$. In this study we measure a city’s ability to attract human capital by looking both at graduates starting a job on the city’s labour market as well as graduates moving into the city’s residential areas as we are interested in disentangling production and consumption effects associated with these different flows. These graduates may have received their degree from a local college or university (i.e. they are retained) or elsewhere. Simply using the size of these flows or scaling them, for example using city population size, will not identify consumption or productivity spillovers over and above the baseline

¹⁶ We computed the VIF values for all the equations in order to check for multicollinearity. The VIF scores are all within established bounds ($VIF < 10$). Results can be provided upon request.

effect of city size since both residential and labour market oriented flows will be larger for larger cities. Instead we have computed our second endogenous variable $GrWork/Liv_{i,t}$ to generate the city-specific ratio of labour market inflow to residential inflow of graduates. This variable indicates whether a city's inflow is relatively labour market dominated (values larger than one) or relatively strongly oriented towards residential areas (values below unity). A positive coefficient for this variable in the $JobSh_Sk_{s,i,t}$ equation will then signal labour market or productivity effects. A negative coefficient indicates stronger residential effects or, put otherwise, an effect driven by consumption spillovers.

City-specific employment in terms of the skill levels demanded by the employers is derived from the Working Conditions Survey (WCS)¹⁷ published by the Dutch Ministry of Social Affairs and Employment. We use the School-leaver Information System (ROA – SIS) dataset from the Research Centre for Education and the Labourmarket (Maastricht University) and Statistics Netherlands data to compute the flows of graduates towards a city's labour and housing markets (variable “GrWork/Liv”). Comparing the 1998 values of our endogenous variables with the 2008 values, it becomes clear that, in our sample of cities, the share of jobs for which only a low skills level is required (JobShLowSk) has particularly declined. This is mirrored by the changes in the proportion of workers that have a low education level. The proportion of jobs requiring higher skills has increased (JobShHighSk), as has the corresponding education share (JobShHighEduc). Interestingly, the share of elementary skilled jobs has remained more or less stable, as have medium and scientific level jobs. The mean value for GrWork/Liv has increased somewhat, from 0.75 to 0.80. This indicates that, at least in our sample of cities, the labour market inflows have on average become more important relative to the inflows into the residential market. The variance has also declined somewhat.

5.3.2 Exogenous variables

Based on the literature findings discussed earlier, we introduce a number of exogenous control variables alongside the time lags of the dependent variables. The exogenous variables in both equations include controls for city size, size of neighbouring cities, a set of controls for the city's economic situation and amenity characteristics plus control variables describing the composition of the inflow of graduates and the presence of universities. Below, we briefly introduce these variables.

¹⁷ In Dutch: Arbeidsvoorwaarden Onderzoek (AVO). This survey is an annual, from 1992 onwards, representative cross-sectional sample of firms and their employees. On average, 37,000 employees in 2000 firms are surveyed.

A novel element in this study is separately controlling for the effects on the city's skills structure of the skill levels required for the city's existing stock of jobs (relevant to the productivity effects discussed earlier) and the education level of the city's resident population (in relation to consumption spillovers). In the JobSh_Sk equations, the lagged dependent variable, along with the other four skills categories, control for the existing stocks of jobs by the skill levels required (variables "JobShElemSk" to "JobShScienSk"). The education levels of the city's inhabitants (variables "PopShLowEduc" to "PopShHighEduc") are based on Statistics Netherlands data, using the three way (low, medium, high) ISCED classification. In this study we use the education level of the potential labour force (aged 19 – 65) by residential area, data which can be derived from the Statistics Netherlands Labour Force Survey. In addition to the effects of the consumption by higher educated residents on low skilled service industries (Sassen, 2001, Poelhekke, 2006), Moretti (2004b) and Shapiro (2006) note that a higher educated resident population may uphold certain facilities in cities, alongside exhibiting higher rates of social activity. As such, it will be interesting to see whether the consumption effect of the skills structure of a city's resident population is significantly associated with lower or higher skilled jobs, over and above the effect of the employment skills structure.

In both equations, we control for city size and the size of neighbouring cities. It will be interesting to see whether the effect of the skills structure in general is significant, given the general demand effect of having access to a large market. In order to separate the effect of tastes and participation from the more general effective demand effect of higher wage levels for the higher educated population, we also enter the proportion of low income households (variable "ShLowIncHH", again based on Statistics Netherlands data). Through this additional control, the variables measuring the resident population's skills structure are 'cleaned' of any income effect and better reflect their different effects on the city's skills structure, through tastes, participation or the relationship with the city's facility structure. The income effect is itself indicative of the role a city's purchasing power plays in determining its skills structure.

Earlier, from the literature, it was concluded that it is important to control for factors that simultaneously influence the presence of human capital, the city's skills structure and employment growth (Shapiro, 2006). In many studies, variables are added that reflect the economic structure of a city, alongside some assessment of amenity richness of the city or surrounding region. Often natural amenities, such as the vicinity of beaches, are used in this respect. The effect of such amenities on economic conditions has also been criticised (Storper and Scott, 2009). Including amenities such as theatres and restaurants assumes that these are indeed valued by the group under study. To avoid this issue, we have decided to use somewhat more general measures

reflecting housing costs and crime rates. In line with Gottlieb's (1995) findings, we do not assume that residential amenities only affect the population since firms may well take residential amenities, in potential housing areas for their staff, into account when choosing a production location.

Table 5.1: Sample statistics, N = 293.

Name	t-10 values (1998)				t+0 values (2008)			
	Mean	St.dev.	Min	Max	Mean	St.dev.	Min	Max
<i>Dependent / endogenous variables</i>								
JobShElemSk	8.09	6.78	0.39	47.24	8.71	8.23	0.10	43.67
JobShLowSk	31.30	10.64	4.66	63.83	27.65	10.31	3.65	63.12
JobShMedSk	41.74	10.14	12.70	68.50	41.82	9.60	16.02	75.14
JobShHighSk	14.76	9.93	1.86	47.59	17.09	8.80	3.13	54.80
JobShScienSk	4.31	5.88	0.09	50.52	4.68	5.86	0.04	50.86
JobShLowEduc	33.27	10.43	7.81	67.23	28.06	10.56	4.63	56.96
JobShMedEduc	47.33	10.17	12.15	73.04	48.02	8.59	20.25	76.58
JobShHighEduc	19.40	12.37	2.69	80.05	23.93	11.29	7.76	66.29
GrWork/Liv	0.75	0.53	0.00	3.42	0.80	0.48	0.03	3.35
<i>Independent variables: spatial lags of endogenous variable (using commuting matrix)s</i>								
WCJobShElemSk	7.28	1.46	2.99	12.98				
WCJobShLowSk	28.00	2.70	20.59	35.50				
WCJobShMedSk	40.58	4.02	27.74	50.11				
WCJobShHighSk	18.00	4.08	7.16	26.84				
WCJobShScienSk	6.32	2.40	1.88	16.81				
WCJobShLowEduc	29.91	4.31	20.64	42.91				
WCJobShMedEduc	46.37	4.33	36.68	57.72				
WCJobShHighEduc	23.72	5.34	9.13	39.28				
WCGrWork/Liv	2.20	0.85	0.99	5.96				
<i>Independent variables: education level of resident city population (shares)</i>								
PopShLowEd	39.00	6.63	22.22	58.36				
PopShMedEd	42.18	4.18	32.14	54.09				
PopShHighEd	18.81	6.80	7.57	40.14				
<i>Independent variables: total city population, total number of city jobs (natural logarithm and spatial lag using 1st order queen contiguity matrix)</i>								
LnPopTot	-1.06	0.67	-2.20	1.97				
WNLnPopTot	-0.93	0.59	-2.19	0.93				
LnJobTot	-2.09	0.86	-3.92	1.33				
WNLnJobTot	-1.82	0.75	-3.60	0.31				
<i>Independent variables: city level economic control variables</i>								
Shock	4.02	0.54	2.81	6.02				
FrmSize	0.93	0.31	0.33	2.28				
Unem	4.60	2.02	0.00	11.40				
ShLowIncHH	27.13	4.58	16.07	39.26				
<i>Independent variables: city level amenity control variables</i>								
LnHousP	0.09	0.23	-0.63	0.81				
Crime	7.02	3.43	1.13	21.68				
<i>Independent variables: city level graduate presence and flow composition control variables</i>								
Grads	0.23	0.93	0.00	8.21				
WCGrads	0.94	0.33	0.20	1.99				
Soc/Tech	1.45	1.48	0.02	15.00				
WCSoc/Tech	1.49	0.40	0.65	3.68				
GrC/NcJobs	5.57	5.31	0.13	51.00				
WCGrC/NcJobs	4.97	1.01	3.01	8.82				
GrC/NcEduc	0.08	0.10	0.01	1.00				
WCGrC/NcEduc	0.09	0.03	0.04	0.30				

We use the LISA register of firms' data (1996 – 2009 available) to compute the average firm size (variable "FrmSize") in a city. Larger firms are often assumed to be less economically dynamic (Blien *et al.*, 2006) but may offer a wider range of employment opportunities for different skills groups. We also use the LISA dataset to compute the variable "Shock" that functions as a control for nationwide production shocks. Following Katz and Murphy (1992), we weigh national single-digit NACE

sector-specific yearly employment growth by the city's sectoral structure. In other words, we reweight the national growth rate by the city's employment structure. This variable first controls for effects related to having a favourable, in terms of the business cycle, sectoral structure on the city's skills structure. Given the growth in the Dutch service sector in the period studied, we would expect that this to largely translate into employment opportunities for the higher skilled. Second, it acts as a general control for a city's industry structure. Data on housing prices ("LnHouseP"), crime rates ("Crime") and unemployment rates ("Unem") are all computed from Statistics Netherlands data.

We include the number of graduates that left university or colleges of higher education by city (the variable "Grads"). Naturally, this variable is 0 for all cities that do not have such institutions within their borders. This variable controls for the effect on the skills structure and graduate inflow of the presence of such institutions in cities. In addition we control for the composition of graduate flows, in terms of academic disciplines and line of work. Earlier research has shown that there are substantial differences in migration patterns between graduates with different academic degrees (Venhorst *et al.*, 2010). In this study, we distinguish between social sciences on the one hand and the natural and engineering sciences on the other: the variable "Soc/Tech" reflects the inflow of the former relative to the latter. We also look at the inflow of graduates that have completed a degree in a creative field, relative to the inflow of graduates in all other fields. We adopt the classification proposed by Comunian *et al.* (2010), resulting in the variable GrC/NcEduc. Next to this, we look at the inflow of graduates to city-based creative occupations relative to the inflow in non-creative occupations (variable GrC/NcJobs), based on the classification of Boschma and Fritsch (2009). Marlet and Woerkens (2007) studied the effect of the proportion of creative workers on employment growth in fifty Dutch cities and found that this predicted growth better than traditional measures of human capital. According to the authors, this could be related to the growth rate of specific industries, such as knowledge intensive industries, in which these creative occupations are well represented. In this light, we would expect to see an additional effect of creative inflow on especially the higher skilled jobs and higher educated population. All these exogenous variables are based on the ROA School-leaver dataset.

Given the findings in Boarnet (1994) and Boarnet *et al.* (2005), we include spatial lags of some of the key endogenous and exogenous variables in our analysis. Florax and Folmer (1992) also recommended such an approach when faced with substantive spatial spillovers. The spatial scale of Dutch cities is relatively small and, as a result, strong interrelationships can be expected to exist between them. Boarnet *et al.* (2005) compare various spatially weighted matrix specifications in the context of

modelling population and employment interactions. They conclude that there is no single best fit, and that the substantive interpretation of results is best served by using a spatially weighted matrix that leaves room for interpretation. In this study we therefore apply a row-normalised commuting matrix to compute the spatial lags of the relevant exogenous variables. We construct our row-normalised spatial interaction matrix using data on the 2009¹⁸ commuting flows, but including only those flows of a substantial size. The off diagonal elements of the non-normalised base matrix were designated 0 if the flow was smaller than 100 commuting individuals and 1 if the flow was larger. Using a time varying matrix with values reweighted according to flows would, in our view, introduce substantial levels of endogeneity in the specification and therefore, after row-normalising, we do not reweight the spatially lagged variable according to flow size. Rather, the spatially lagged variable simply reflects the average value for municipalities with which a commuting relationship exists. All variables with the prefix ‘WC’ are computed using this matrix.

5.4 Results

In Table 5.2, the results for our 3SLS models are presented. Each of our five models consists of two equations: one for the city-level employment distribution by skill level required, and one for the city inflow of graduates onto the labour market, relative to their inflow onto the housing market. We use the specific skill level being considered to identify the two equation model: so, for example, model E refers to elementary skills, model S refers to the model for scientific skills. The coefficients for all the equations are jointly significant, judging by the CHI^2 values; and the R^2 values for all equations are at an acceptable level. We start our discussion by considering the results for the key endogenous variables in the analysis. This is followed by a discussion of the results for the other exogenous variables and a robustness check.

5.4.1 *The relationship between skills structure and graduate human capital inflows*

In this chapter, we study the relationship between a city’s skills structure and the inflow of graduate human capital. This inflow is measured as the inflow of recent graduates onto the city labour market relative to the inflow onto the city housing market. Therefore, the larger the variable GrWork/Liv is, the more strongly graduate inflows are focussed on the city’s labour market opportunities. Our models found a

¹⁸ Commuting matrices for 2006 through to 2009 are currently available from Statistics Netherlands. As our analysis covers 1998 – 2008, we have selected the 2009 matrix to avoid endogeneity issues. Further, our focus is on the more substantial flows, and these do not vary over time to a large degree. We have also recoded them using dummy values, leading to a rather general system of important flows, and so the year chosen should not substantially affect the results.

negative coefficient for the endogenous variable GrWork/Liv for a city's share of low and medium skilled jobs. This implies that a relatively strong inflow of recent graduates onto the city housing market has positive effects on the share of lower and medium skilled jobs in that city. This can be interpreted as a consumption spillover. On the other hand, we also find a positive coefficient for GrWork/Liv in our model for the share of scientific-level jobs in the city. A city's relatively strong ability to attract or retain graduate human capital onto its labour market leads to a stronger position in terms of jobs that require scientific skills. This in itself is indicative of an accumulation of skills in certain cities. We do not find significant effects for the elementary and higher skills groups.

Looking at the reverse relationship, i.e. the effect of a city's skills structure on the inflow of graduate human capital, we find a negative effect in models H and S for the endogenous variables of higher and scientific level jobs. This result may seem rather counter-intuitive, since one might expect that having a high proportion of such jobs would make the city an attractive place to work for the group under consideration. However, in our approach we control for the number of job opportunities in the local labour market, and this has been found to be a strong determinant of graduate study-to-work location migration in the Netherlands (Venhorst *et al.*, 2011a). It would seem that this size effect dominates any effect of the skills structure. An alternative interpretation here is that recent graduates have a tendency to select a residential location close to where suitable employment opportunities are found. A frequent choice is to remain in the college or university city, albeit in a different residence, and look for employment from there (Venhorst *et al.*, 2011b). We also find a positive and significant effect for the proportion of elementary skilled jobs. One possible explanation here is that cities that provide good working opportunities for recent graduates have an economic structure that provides opportunities right across the skills spectrum.

5.4.2 The effect of existing city stocks of human capital

In the employment equation, we have entered each city's skills structure for 1998 (variables JobShElemSk to JobShScienSk) in order to control for the effect of existing human capital stocks. This structure includes the t-10 years lagged value of the dependent variable, along with those of the four other skills categories. All the lagged dependent variables were significantly different from zero, except JobShElemSk (employment equation in model E). The interpretation here is that, given the other covariates, the proportion of elementary skilled jobs does not depend on a city's endowments of elementary jobs. This implies that there are stronger dynamics at play for this category over time. The strongest auto-regressive effect found was for scientific skilled jobs in model S (JobShScienSk) with a value of 0.51. .

Table 5.2: 3SLS models, jobs by skill level required / inflow of graduates on city labour or housing market, all variables entered for 1998 unless stated otherwise.

	3SLS, model E JobShElemSk ₂₀₀₈	3SLS, model L JobShLowSk ₂₀₀₈	3SLS, model M JobShMedSk ₂₀₀₈	3SLS, model H JobShHighSk ₂₀₀₈	3SLS, model S JobShScienSk ₂₀₀₈
<i>Endogenous variable</i>					
GrWork/Liv ₂₀₀₈	-0.47	-5.17 ***	-4.91 ***	1.83	1.59 **
WGrWork/Liv	0.81	4.86	1.75	1.06	1.91
<i>City stocks of human capital: jobs by skill level and population by education, lag of dependent variable</i>					
JobShElemSk	0.04	0.01	0.03	0.02	-0.12 ***
JobShLowSk	-0.04	0.13 ***	0.08 *	-0.03	-0.12 ***
JobShMedSk	0.07	0.04	0.11 ***	-0.02	-0.11 ***
JobShHighSk	-0.03	-0.09	0.01	0.23 ***	-0.16 ***
JobShScienSk	-0.04	-0.08	-0.23 ***	-0.20 ***	0.51 ***
PopShLowEduc	0.18	0.16 **	-0.14 **	-0.19 ***	0.00
PopShMedEduc	-0.02	0.10	0.22 **	0.06	-0.01
PopShHighEduc	-0.16	-0.26 ***	-0.07	0.14 ***	0.01
<i>Size of city and surrounding cities</i>					
LnPopTot	-2.46 **	-1.21	0.95	1.62 *	-0.25
WNLnPopTot	-0.76	-0.36	-2.24 ***	1.76 ***	0.65 *
<i>City economic control variables</i>					
Shock	0.25	2.25 *	1.39	3.47 ***	0.62
FirmSize	1.72	1.62	2.38	0.99	-0.94
Unem	-0.18	0.68 **	0.33	-0.77 ***	-0.09
ShLowIncHH	-0.03	0.15	0.84 ***	0.20	0.02
<i>City amenity control variables</i>					
LnHousP	-0.13	6.64 *	15.33 ***	-9.50 ***	-0.48
Crime	0.12	-0.33	-0.42 **	0.09	0.24 **
<i>Presence of colleges and universities, composition of graduate inflow on city labour markets</i>					
Grads	0.61	-0.53	-1.37 ***	0.32	1.38 ***
WGrGrads	-4.59 ***	-4.43 **	4.28 **	7.09 ***	2.62 ***
SocTech	-0.07	0.20	-0.21	0.62 **	-0.03
WCSocTech	0.07	2.48 *	-3.18 **	-0.44	3.06 ***
GrC/IncJobs	0.01	-0.05	0.17	-0.13	-0.04
WGrC/IncJobs	0.71	0.07	1.03 *	-0.86 **	-0.03
GrC/NCEduc	6.18	5.45	-2.95	0.48	-4.37
WGrC/NCEduc	-16.50	6.28	-5.52	16.31	19.98 **
<i>Goodness of fit</i>					
R ²	0.64	0.92	0.97	0.95	0.92
RMSE	6.03	7.33	7.27	5.31	3.28
CHI ²	530.95 ***	3345.60 ***	8480.76 ***	5382.59 ***	3625.87 ***
<i>Endogenous variable, lag of dependent variable</i>					
Endog: JobSh__Sk ₂₀₀₈	0.02 *	0.01	0.01	-0.01 *	-0.01 **
WJobSh__Sk	-0.01	0.00	0.01	0.00	0.00

GrWorkLiv	0.51	***	0.53	***	0.54	***	0.54	***	0.51	***
<i>Size of city and surrounding cities</i>										
LnJobTot	0.21	***	0.18	***	0.18	***	0.19	***	0.17	***
WNLnJobTot	-0.05	*	-0.05	*	-0.03		-0.04		-0.04	
<i>City economic control variables</i>										
Shock	0.16	**	0.12	**	0.12	**	0.19	***	0.15	***
FmSize	0.06		0.11		0.10	*	0.14	*	0.13	*
Unem	0.05	***	0.04	***	0.04	***	0.04	**	0.04	***
ShLowInchH	0.01		0.01		0.00		0.01		0.01	
<i>City amenity control variables</i>										
LnHousP	0.17		0.12		0.00		0.07		0.14	
Crime	-0.02	***	-0.02	**	-0.02	*	-0.02	***	-0.02	**
<i>Presence of colleges and universities, composition of graduate inflow on city labour markets</i>										
Grads	-0.09	***	-0.08	***	-0.07	***	-0.08	***	-0.07	***
WCGrads	0.13		0.09		0.03		0.15		0.08	
SocTech	0.05	***	0.05	***	0.05	***	0.06	***	0.05	***
WCSocTech	0.05		0.03		0.07		0.03		0.08	
GrC/NcJobs	0.00		0.00		0.00		0.00		0.00	
WGGrC/NcJobs	-0.03		-0.01		-0.02		-0.02		-0.01	
GrC/NCEduc	0.42	*	0.51	*	0.56	*	0.55	*	0.48	*
WGC/NCEduc	0.00		-0.23		-0.32	*	-0.17		0.12	*
Constant	-0.37		-0.54		-0.78	*	-0.34		-0.59	*
N	293		293		293		293		293	
R ²	0.58		0.61		0.59		0.58		0.61	
RMSE	0.32		0.31		0.32		0.32		0.31	
CHI ²	438.90	***	473.74	***	470.82	***	479.91	***	494.85	***

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5.3: 3SLS models, jobs by skill level required / inflow of graduates on city labour or housing market.

N	3SLS, model E JobShElemSk ₂₀₀₈ Endog: GrWork/Liv ₂₀₀₈	3SLS, model L JobShLowSk ₂₀₀₈	3SLS, model M JobShMedSk ₂₀₀₈	3SLS, model H JobShHighSk ₂₀₀₈	3SLS, model S JobShScienSk ₂₀₀₈
293	-0.47	-5.17 ***	-4.91 ***	1.83	1.59 **
219	-0.22	-5.53 ***	-5.31 ***	1.83	1.71 *
147	1.24	-5.85 ***	-4.49 **	1.64	1.42
73	0.60	-5.79 ***	-2.88	1.32	1.19
	GrWork/Liv ₂₀₀₈	GrWork/Liv ₂₀₀₈	GrWork/Liv ₂₀₀₈	GrWork/Liv ₂₀₀₈	GrWork/Liv ₂₀₀₈
293	Endog: JobSh____Sk ₂₀₀₈ 0.02 *	0.01	0.01	-0.01 *	-0.01 **
219	0.03 **	0.01	0.01	-0.02 **	-0.01 **
147	0.04 **	0.01	0.01	-0.01 *	-0.01 **
73	0.03	0.02 *	0.02	-0.02 *	-0.02 ***
	3SLS, model A.L JobShLowEduc ₂₀₀₈	3SLS, model A.M JobShMedEduc ₂₀₀₈	3SLS, model A.H JobShHighEduc ₂₀₀₈		
293	-3.12 **	-6.72 ***	2.76 *		
219	-5.14 ***	-7.60 ***	3.58 **		
147	-3.70 *	-7.92 ***	3.43 *		
73	-3.97 *	-6.86 ***	3.34		
	GrWork/Liv ₂₀₀₈	GrWork/Liv ₂₀₀₈	GrWork/Liv ₂₀₀₈		
293	Endog: JobSh____Sk ₂₀₀₈ 0.00	0.02	-0.01 **		
219	0.00	0.02	-0.02 ***		
147	0.01	0.02	-0.02 ***		
73	0.02 **	0.03 *	-0.02 ***		

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, results for endogenous variables for varying N

That is, such jobs tend to be concentrated in the same cities over time, even after controlling for the presence of universities and colleges and the sector structure.

We find limited evidence for there being positive spillovers across skills categories. We found only that the share of medium skilled jobs positively affects the proportion of elementary skilled jobs (model E) and that the share of lower skilled jobs positively affects the share of medium skilled jobs (model M). This does provide strong support for the existence of production spillovers across skill levels on the Dutch-city scale. The proportion of scientific level jobs negatively affects the proportions of medium and higher skilled jobs (models M and H), pointing to a degree of segregation between cities: one group with a relatively strong presence of scientific jobs, the other with a stronger presence of medium and higher skilled jobs. In this light, the significant negative effect of all other skills categories on the share of scientific level jobs is not surprising (model S).

The employment equations in models E through S also feature the breakdown of education levels in the resident population. Here we again only find positive effects for the employment chances of the ‘dominant’ skills group. The presence of a lowly educated population (PopShLowEduc) has positive effects for the elementary and lower skills groups (models E and L) but negatively affects the medium and higher skilled groups (models M and H). We find the opposite for the PopShHighEduc variable. This implies that consumption spillovers between skills groups also have little or no effect on the skills structure. Rather, we find that they work towards a concentration of skills in cities. Interestingly, we find no effects on the share of scientific level jobs (model S). Consumption effects related to the educational structure of the resident population do not appear to play a role in the localisation of scientific level jobs.

To conclude we turn to the graduate human capital inflow equations. Here, a lag of the dependent variable is also introduced. This is positive and strongly significant in all the models, implying a degree of dynamic stability: a city’s ability to attract human capital to either its labour or its housing market depends strongly on having that ability in the past.

5.4.3 Results for other exogenous control variables and covariates

In this section, we discuss the results for the other control variables that were included in our models. We start with the effect of city size, before moving on to the variables pertaining to a city’s economic and residential amenity qualities. We conclude by considering the effects of the various types of graduate inflow.

5.4.3.1 *City size*

We controlled for city size by entering a city's population total, as well as those of neighbouring cities, in the employment equations. In the GrWork/Liv equations, the total number of jobs in the city and those neighbouring were entered. These variables are intended to control for city, or market, size effects. We found that a city's size in terms of population negatively affects the share of elementary skilled jobs (model E) and positively affects the share of higher skilled jobs. The population size of neighbouring cities is significant and positive in models H and S and negative in model M. This implies that the regional market size influences positively the proportion of higher level jobs, and that a large market results in competition effects for medium skilled jobs, reflecting the limited spatial footprint associated with jobs at this level. This competition effect may also be what drives the negative effect for workers in elementary skilled jobs, who face competition from other individuals within the same city.

The total number of jobs within a city affects GrWork/Liv positively in all the models or, in other words, cities with more jobs relatively strongly attract human capital to their labour opportunities rather than to their residential areas. This is not surprising as many studies have shown that young migrants and recent graduates are drawn to areas that have a large number of job opportunities. Here, we do not find any effect of the number of jobs in neighbouring cities, apart from a negative effect in model L.

5.4.3.2 *City economic and residential controls*

The variable "Shock" transfers national employment growth to a city's sectoral structure. The variable has a positive effect on employment opportunities for lower (model L) and higher skilled jobs (model H). It univocally affects the inflow of human capital positively, implying that cities with a favourable sectoral structure manage to relatively strongly attract graduate human capital to their labour markets.

FirmSize does not affect skills shares in employment, indicating that the presence of large firms does not univocally lead to more employment opportunities for a specific skills group. The variable is however significant and positive in the GrWork/Liv equations in models H and S. We would suggest that large firms are attractive employers for recent graduates given the in-house career opportunities these firms can potentially offer. One possible reason why we did not find this effect in all models, but only in the H and S variants which include the endogenous share of higher or scientific skill-level jobs, is a confounding effect of the negative coefficients we found for JobShHighSk and JobShScienSk in the GrWork/Liv models. Controlling for

the residential effect discussed above may have resulted in a positive effect of FirmSize.

The proportion of lower skilled jobs is higher in cities with relatively high unemployment rates, whereas the share of higher skilled jobs is lower in these areas. Cities with high unemployment rates do still attract graduates to their labour markets, but these may be affected in a limited way by the adverse economic conditions. The proportion of low income households positively affects the proportion of medium-skilled jobs, but was insignificant in the other equations. This implies that there is only a limited effect of purchasing power on a city's skills structure, with consumption effects mainly related to the composition of the population.

The next group of variables is used to reflect a city's residential qualities. LnHousP primarily reflects the cost of living in a city. It can also be interpreted as a measurement of the demand for living in that city. Higher average house prices, in areas that are in residential demand, are associated with higher proportions of lower and medium skilled jobs (models L and M) and lower proportions of higher skilled jobs (model H). This can be interpreted as a consumption effect of residential inflows on the share of lower and medium skilled jobs. We find no effect of this factor on the ability to attract graduate human capital to a city's labour and housing markets. The crime rate in an area is negatively associated with the proportion of medium skill-level jobs (model M) and positively with the share of scientific level jobs. Also, we find that crime rate has a negative effect on GrWork/Liv, in all our models. This suggests a relatively strong residential pull to cities with higher crime rates. This result is counter-intuitive and one should not conclude that recent graduates prefer to live in areas with high crime rates. An alternative explanation is that cities with higher crime rates attract fewer graduates to their labour markets. A lack of job opportunities as a result of a city's poor amenities would be in line with the findings of Gottlieb (1995), who noted that residential amenities can have effects on city employment as employers take them into account in making location decisions.

5.4.3.3 The origins of city graduate inflows

The presence of a university or college, measured as the number of graduates produced by institutions of higher education within the city (the variable "Grads"), has a positive effect on the proportion of elementary (model E) and scientific skilled jobs (model S) and a negative effect on the proportion of medium skilled jobs (model M). Further, having commuting ties with another city that has a university or college serves to increase the general skill levels found within a city's employment possibilities: from elementary and lower, to medium, higher and scientific levels. The presence of a university or college has a negative effect on GrWork/Liv, suggesting that it boosts

residential inflows more than labour market inflows. This again could be the result of graduates electing to remain in their college or university town whilst working in their first job, which might be in that city or elsewhere.

The remaining variables address whether the inflow of graduates onto a city's labour market mainly consists of social science graduates rather than graduates from technical fields (Soc/Tech), whether graduates are taking up creative occupations rather than other types of jobs (GrC/NcJobs) and, thirdly, whether the inflow consists of graduates having predominantly studied creative arts rather than other fields ("GrC/NcEduc"). We also include spatial lags for these variables by using a commuting matrix. The resulting variables indicate mean values for those cities that have a commuting relationship.

There does not emerge a clear picture with respect to these variables from the employment equations in all five models. We only find one positive effect, in model H from Soc/Tech, which indicates that a large inflow of social sciences graduates, relative to technical graduates, is linked to a higher proportion of high-skilled jobs. In terms of spatial spillover, being close to a technical cluster (reflected in a low value for WCSoc/Tech) apparently boosts medium skilled jobs, but decreases the proportions of both lower and scientific level jobs. Also, being close to cities with relatively strong inflows into creative occupations shifts a city's skills structure from higher to medium level jobs. Cities with a high proportion of scientific-level jobs often have cities within commuting distance that have strong inflows of creative graduates. Looking at the GrWork/Liv equations, we find a consistent and positive effect for Soc/Tech, which suggests that cities with large inflows of social-science graduates attract relatively large numbers of graduates in general to their labour markets. Also, we find a general positive effect for GrC/NcEduc, indicating that cities that attract relatively large numbers of creative graduates also attract relatively large numbers of graduates in general to their labour markets. The other characteristics have no significant influence. In theory, these results could be linked to relatively favourable developments in the related economic sectors, although here this is controlled for through the Shock variable. An alternative explanation is a positive effect on the quality of life, although one would have expected this to more strongly boost residential inflows rather than labour market inflows of recent graduates. Again this could be an indication that amenities do matter in firms' choosing locations (Gottlieb, 1995). A final observation is that, in contrast to the findings from the employment equations, the inflow of graduates does not appear to be influenced by what is happening in other cities.

The results for these variables are therefore somewhat mixed. This may be related to the spatial structure of these variables. Large cities, which are often regarded as creative magnets, do not actually score very highly in terms of creative inflow, with

the relative number of non-creative jobs often exceeding that of medium-sized towns, for which we have found positive effects on labour market inflows. Our approach of taking relative shares, rather than absolute numbers or scaled measures of creative inflow, is necessitated by the otherwise risk of encountering multicollinearity with other variables that pick up city size.

5.4.4 Robustness checks: heterogeneity and jobs by education level

A substantial source of heterogeneity is related to our unit of analysis: Dutch municipalities. Our results are based on a set of 293 municipalities, weighted for population size. This has helped to prevent heterogeneity issues, but different processes may play a role in different subsets of cities according to their size. In Table 5.3 we present the coefficients of our key endogenous variables that result when we rerun our model using smaller subsets of municipalities, and increasingly focus on larger cities. To aid comparison, the top row repeats our earlier results. We then, in steps, exclude the smallest quarter of municipalities in terms of population size. As can be gathered from Table 5.3, our main results remain quite robust until we include only the largest municipalities (25%: 73 out of the total of 293). Here we find different results for the lower skills groups. The effect of graduate inflow on scientific-level jobs was rendered insignificant when we constrained our sample to the top 147 municipalities. These changes in the significance of the results could be the result of reduced statistical power as a result of a smaller N, but it also seems not unreasonable that focussing on different subsets of cities leads to different results. We originally elected to focus on the largest subset possible, as this provides a better counter-story to what is happening in the largest cities in the Netherlands.

Further, in Table 5.B.1 in the appendices, we show equivalent results when repeating the analysis but instead breaking down the division of jobs by education level of the worker, rather than the skill level required. The full results for the A.L, A.M and A.H models based on all 293 municipalities can be found in Appendix 5.B. Qualitatively, the results are the same. However, using five skill levels in distinguishing the job market does have the benefit of more precisely identifying effects for specific skills groups such as the elementary and scientific levels.

5.5 Conclusions

In this chapter we have studied the recursive relationship between a city's skills structure and the inflow of graduate human capital onto its labour and housing markets. Local policymakers devote much attention to retaining and attracting individuals with high human capital. However, not much is known on how these

inflows impact on the city's skills structure: are there only effects for the higher skilled, or do other groups stand to gain as well? Furthermore, is the effect of graduate human capital inflows significant over and above the effects of existing city endowments of human capital, and the effects of neighbouring areas? We have applied a dataset that allows us to study these issues for 293 larger Dutch municipalities, over the period 1998 – 2008, using a two-equation 3SLS model that takes the endogeneity of the city's skills structure and the attraction of graduate human capital into account.

Our main finding is that there are positive effects on other skills groups from the inflow of graduate human capital. A relatively strong inflow onto city labour markets leads to an improved position in terms of jobs for which a scientific skills-level is required, indicating a productivity spillover for this group. Further, the share of lower and medium level jobs improves as a result of a relatively strong inflow on city residential markets. This suggests the existence of consumption spillovers in Dutch cities.

However, graduate inflows do not only cause changes in a city's skills structure; they are themselves influenced by this structure. Having large proportions of higher and scientific level jobs leads to relatively stronger inflows of recent graduates into residential areas than into jobs. This somewhat counter-intuitive result can be explained by graduates remaining in their university or college city whilst looking for work in that city or cities within reasonable commuting distances. The positive effect of the presence of colleges and universities on graduate residential inflow emphasises this. This is also in line with earlier findings which show that institutions of higher education act as conduits for drawing human capital to regions. It also illustrates a point made in recent literature - that factors which may be thought of as purely economic strengths or, conversely, only as residential amenities, can in fact play a role in both types of inflow. High crime rates, for example, affect graduate labour market inflow negatively, although this may be related to firm location choice. We have found that labour market inflows of graduate human capital are mainly driven by market size effects, for example the presence of a large number of jobs, in the city or in the immediate vicinity, or the presence of large firms.

Secondly, this chapter demonstrates the value of carefully distinguishing between the skill levels required for the jobs located in the city and the education levels of the resident population. We have shown that these two stocks of human capital present in a city simultaneously influence the city's skills structure, either through production (jobs by skill level) effects or through consumption (resident population by education) effects. However, we found little evidence of positive spillovers between skills groups: the main effects are found to be a strengthening of the position of one's own skills group. The consumption effect of an inflow of recent

graduates on the lower and medium skilled residents is an exception in that sense. This is in line with the idea of skills becoming concentrated in certain cities. We observed this most clearly for scientific-level jobs.

Thirdly, we have followed trends in the recent literature by including information on cities with which a commuting relationship exists. Further, we have included a market potential variable that takes into account the size of neighbouring cities. We found some spatial effects on the city skills structure, and this, importantly, appears to affect different skills groups in different ways. Being close to large cities has positive effects for the higher skills groups but proves competitive for the medium skills groups. The presence of colleges and universities within commuting distance serves to increase the level of skills in a city. Further, the type of graduate inflow that cities within commuting distance manage to attract has an effect. Most notably, it makes a difference whether these cities attract social science or technical graduates, and whether or not these graduates have studied or are in creative jobs. The evidence is somewhat mixed however since graduate inflow is hardly affected by spatial spillovers.

Our analysis demonstrates that there is plenty of scope to focus upon in attracting human capital flows to both a city's labour as well as its housing markets. However, many of the factors that were demonstrated to be of relevance in this study are difficult for policymakers in individual cities to influence, especially in the short term. Given some of the key mechanisms in play, policymakers should focus on establishing the role of their city in the wider region and the national urban hierarchy. What are the city's characteristics, and how does that relate to the characteristics of other cities? One can think of the effects of size, the existence of consumption spillovers, proximity to colleges and universities, but also the degree to which a large proportion of scientific-level jobs is already present in the city, as elements that are crucial in determining a city's role and opportunities.

References

- Acemoglu, D. and Angrist, J. (2000) How large are human capital externalities? Evidence from compulsory schooling laws. *NBER Macroeconomics Annual*, 15, 9-59.
- Arellano, M. and Bond, S. (1991) Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, 58, 277-297.
- Berry, C. R. and Glaeser, E. L. (2005) The divergence of human capital levels across cities. *Papers in Regional Science*, 83(3), 407-444.
- Bils, M. and Klenow, P. J. (2000) Does schooling cause growth? *The American Economic Review*, 90(5), 1160-1183.

- Blien, U., Suedekum, J. and Wolf, K. (2006) Local employment growth in West Germany: a dynamic panel approach. *Labour Economics*, 13(4), 445-458.
- Boarnet, M. G. (1994) The monocentric model and employment location. *Journal of Urban Economics*, 36(1), 79-97.
- Boarnet, M. G., Chalermpong, S. and Geho, E. (2005) Specification issues in models of population and employment growth. *Papers in Regional Science*, 84(1), 21-46.
- Boschma, R. A. and Fritsch, M. (2009) Creative class and regional growth: empirical evidence from seven European countries. *Economic Geography*, 85(4), 391-423.
- Broersma, L., A.J.E. Edzes and J. van Dijk (2010) Human Capital Externalities and proximity: Effects for Low Skilled Workers, *North American Regional Science Council 2010 conference*, Denver, CO, U.S.A.
- Carlino, G. A. and Mills, E. S. (1987) The determinants of country growth. *Journal of Regional Science*, 27(1), 39-54.
- Combes, P., Magnac, T. and Robin, J. (2004) The dynamics of local employment in France. *Journal of Urban Economics*, 56(2), 217-243.
- Comunian, R., Faggian, A. and Li, Q. C. (2010) Unrewarded careers in the creative class: The strange case of bohemian graduates. *Papers in Regional Science*, 89(2), 389-410.
- Di Pietro, G. and Urwin, P. (2006) Education and skills mismatch in the Italian graduate labour market. *Applied Economics*, 38, 79-93.
- Duranton, G. and Puga, D. (2004) Microfoundations of urban agglomeration economies. In J. V. Henderson and J. F. Thisse (Eds.), *Handbook of urban and regional economics* Elsevier B.V.
- Faggian, A. and McCann, P. (2006) Human capital flows and regional knowledge assets: a simultaneous equation approach. *Oxford Economic Papers*, 52, 475-500.
- Faggian, A. and McCann, P. (2008) Human capital, graduate migration and innovation in British regions. *Cambridge Journal of Economics*, 33(2), 317-333.
- Faggian, A. and McCann, P. (2009) Human capital and regional development. In R. Capello and P. Nijkamp (Eds.), *Handbook of regional growth and development theories* (pp. 133-151). Cheltenham, UK: Edward Elgar.
- Florax, R. J. G. M. and Folmer, H. (1992) Specification and estimation of spatial linear regression models; monte carlo evaluation of pre-test estimators. *Regional Science and Urban Economics*, 22, 405-432.
- Glaeser, E. L. (1999) Learning in cities. *Journal of Urban Economics*, 46(2), 254-277.
- Glaeser, E. L. and Gottlieb, P. D. (2006) Urban resurgence and the consumer city. *Urban Studies*, 8, 1275-1299.
- Glaeser, E. L., Kallal, H. D., Scheinkman, J. A. and Shleifer, A. (1992) Growth in cities. *The Journal of Political Economy*, 100(6), 1126-1152.
- Glaeser, E. L., Kolko, J. and Saiz, A. (2001) Consumer city. *Journal of Economic Geography*, 1, 27-50.
- Glaeser, E. L. and Maré, D. C. (2001) Cities and skills. *Journal of Labor Economics*, 19(2), 316-342.
- Glaeser, E. L. and Saiz, A. (2004) The rise of the skilled city. *Brookings-Wharton Papers on Urban Affairs*, 47-105.
- Glaeser, E. L., Scheinkman, J. A. and Shleifer, A. (1995) Economic growth in a cross-section of cities. *Journal of Monetary Economics*, 36(1), 117-143.
- Gottlieb, P. D. (1995) Residential amenities, firm location and economic development. *Urban Studies*, 32(9), 1413-1436.

- Hoogstra, G. J., Van Dijk, J. and Florax, R. J. G. M. (2011) Determinants of variation in Population–Employment interaction findings: A quasi-experimental meta-analysis. *Geographical Analysis*, 43(1), 14–37.
- Hoogstra, G. J., Florax, R. J. G. M. and Van Dijk, J. (2005) Do ‘jobs follow people’ or ‘people follow jobs’? A meta-analysis of Carlino-Mills studies. *European Regional Science Association*, Amsterdam.
- Jovanovic, B. and Rob, R. (1989) The growth and diffusion of knowledge. *The Review of Economic Studies*, 56(4), 569-582.
- Katz, L. F. and Murphy, K. M. (1992) Changes in relative wages, 1963-1987: Supply and demand factors. *The Quarterly Journal of Economics*, 107(1), 35-78.
- Krugman, P. (1991) Increasing returns and economic geography. *The Journal of Political Economy*, 99(3), 483-499.
- Lucas, R. E. (1988) On the mechanics of economic development. *Journal of Monetary Economics*, 22, 3-42.
- Marlet, G. and Van Woerkens, C. (2007). The Dutch creative class and how it fosters urban employment growth. *Urban Studies*, 44(13), 2605-2626.
- Moretti, E. (2004a) Estimating the social return to higher education: Evidence from longitudinal and repeated cross-sectional data. *Journal of Econometrics*, 121, 175-212.
- Moretti, E. (2004b) Human capital externalities in cities. In J. V. Henderson and J. F. Thisse (Eds.), *Handbook of urban and regional economics*, Elsevier B.V.
- Moretti, E. (2004c) Workers' education, spillovers, and productivity: Evidence from plant-level production functions. *The American Economic Review*, 94(3), 656-690.
- Nijkamp, P. and Poot, J. (1998). Spatial perspectives on new theories of economic growth. *Annals of Regional Science*, 32, 7-37.
- Partridge, M., Bollman, R. D., Olfert, M. R. and Alasia, A. (2007a) Riding the wave of urban growth in the countryside: spread, backwash, or stagnation? *Land Economics*, 83(2), 128–152.
- Partridge, M., Olfert, M. R. and Alasia, A. (2007b) Canadian cities as regional engines of growth: agglomeration and amenities. *Canadian Journal of Economics*, 40(1), 39-68.
- Poelhekke, S. (2006) Do amenities and diversity encourage city growth? A link through skilled labor. *European University Institute Working Papers*, 2006-10.
- Rauch, J. E. (1991) *Productivity gains from geographic concentration of human capital: Evidence from the cities*. Cambridge MA: National Bureau of Economic Research.
- Rodríguez-Pose, A. and Vilalta-Bufí, M. (2005) Education, migration, and job satisfaction: The regional returns of human capital in the EU. *Journal of Economic Geography*, 5, 545-566.
- Sassen, S (2001) *The Global City: New York, London, Tokyo*. Princeton University Press, New Jersey.
- Schlitte, F. (2010) *Local human capital, segregation by skill, and skill-specific employment growth*. German Federal Employment Agency.
- Shapiro, J. M. (2006) Smart cities: Quality of life, productivity and the growth effects of human capital. *The Review of Economics and Statistics*, 88(2), 324-335.
- Storper, M. and Scott, A. J. (2009) Rethinking human capital, creativity and urban growth. *Journal of Economic Geography*, 9, 147-167.
- Suedekum, J. and Blien, U. (2005) Local economic structure and industry development in Germany, 1993–2001. *Economics Bulletin*, 17, 1-8.

- Suedekum, J. (2009) Convergence of the skill composition across German regions. *Regional Science and Urban Economics*, 38, 148–159.
- Venhorst, V. A. and Cörvers, F. (2010) Entry into working life: Spatial mobility and job-match quality of higher educated graduates. *Conference of the North American Regional Science Council*, Denver, CO, USA.
- Venhorst, V. A., Van Dijk, J. and Van Wissen, L. J. G. (2010) Do the best graduates leave the peripheral areas of the Netherlands? *Tijdschrift voor economische en sociale geografie*, 101(5), 521–537.
- Venhorst, V. A., Van Dijk, J. and Van Wissen, L. J. G. (2011a) An analysis of trends in spatial mobility of Dutch graduates. *Spatial Economic Analysis*, 6(1), 57-82.
- Venhorst, V.A., A.J.E. Edzes, L. Broersma and J. van Dijk (2011b) *Brain Drain of Brain Gain? Hoger opgeleiden in grote steden in Nederland*. Nicis Institute, The Hague, The Netherlands.

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Appendix 5.A: variable descriptions and data sources

City-specific employment by the skill levels demanded by employers is not readily available for many Dutch cities¹⁹. We therefore derive this information from the Working Conditions Survey (WCS)²⁰ produced by the Dutch Ministry of Social Affairs and Employment, a process that involves three steps.

In the WCS, the location of a firm is reported at the level of two-digit postcode areas, of which there are a total of 90 in the Netherlands. In the first step, for each two-digit postcode area, the skills structure of employment is derived from the WCS for each single-digit NACE sector. The data for a given year is based on a three-year moving average. The skills structure is recorded in the WCS using an internal classification, but this can be converted to the Statistics Netherlands SBC-‘92 / 2001 classification, which in turn is related to the International Standard Classification of Occupations 1988 (ISCO). We use five mutually exclusive levels: jobs requiring elementary, lower, medium, higher and scientific skills. This first step results in information on the skills structure of employment, for each single-digit NACE sector, in each of the 90 double-digit postcode areas.

In this study, the focus is on cities (municipalities), the administrative units that local policymakers are generally working with. However, each two-digit postcode area usually contains more than one municipality or parts thereof. Therefore, in a second step, municipalities are assigned to the two-digit postal code area in which the largest proportion of their residents live. In a few instances, a large city will fully occupy a two-digit postcode area.

In the third step, the sector-specific skills structure (in terms of shares) for a given two-digit postcode is then assigned to the cities, deemed to fall within that area, by multiplying the proportions in these sectors by the number of workers²¹. This results in the city-specific job totals by skill level required. From this, we then compute the skills shares (variables JobShElemSk to JobShScienSk) that we use in this study to describe the city skills structure²².

¹⁹ Based on the Labour Force Survey (EBB). Statistics Netherlands provides information on worker education level for large Dutch cities, but this information is geo-referenced according to the residence of the worker involved, not the location of the job.

²⁰ In Dutch: Arbeidsvoorwaarden Onderzoek (AVO). This survey, undertaken from 1992 onwards, is a representative annual cross-section of firms and their employees. On average a survey covers 37,000 employees in 2000 firms.

²¹ The number of workers per single-digit NACE sector in a city was computed using Statistics Netherlands microdata (SSB-Banen).

²² The city-specific education levels, for employees working in that city, applied in the models in Appendix 5.B were derived in a similar fashion. The education level by worker occupying a job located in a given city

Table 5.A.1: Variable descriptions and data sources.

Name	Description	Data source
JobShElemSk	Share of city jobs of elementary skill level	1
JobShLowSk	Share of city jobs of lower skill level	1
JobShMedSk	Share of city jobs of medium skill level	1
JobShHighSk	Share of city jobs of higher skill level	1
JobShScienSk	Share of city jobs of scientific skill level	1
JobShLowEduc	Share of city jobs held by lower educated workers	1
JobShMedEduc	Share of city jobs held by medium educated workers	1
JobShHighEduc	Share of city jobs held by higher educated workers	1
GrWork/Liv	Recent graduates entering city labour market / city housing market	4, 2
WCJobShElemSk	Spatial lag of JobShElemSk, using row-normalised commuting matrix	1
WCJobShLowSk	Spatial lag of JobShLowSk, using row-normalised commuting matrix	1
WCJobShMedSk	Spatial lag of JobShMedSk, using row-normalised commuting matrix	1
WCJobShHighSk	Spatial lag of JobShHighSk, using row-normalised commuting matrix	1
WCJobShScienSk	Spatial lag of JobShScienSk, using row-normalised commuting matrix	1
WCJobShLowEduc	Spatial lag of JobShLowEduc, using row-normalised commuting matrix	1
WCJobShMedEduc	Spatial lag of JobShMedEduc, using row-normalised commuting matrix	1
WCJobShHighEduc	Spatial lag of JobShHighEduc, using row-normalised commuting matrix	1
WCGrWork/Liv	Spatial lag of GrWork/Liv using row-normalised commuting matrix	4
PopShLowEd	Share of city population with lower education level	1
PopShMedEd	Share of city population with medium education level	1
PopShHighEd	Share of city population with higher education level	1
LnPopTot	ln(Total city population)	1
WNLnPopTot	Spatial lag of LnPopTot using 1st order queen contiguity matrix	1
LnJobTot	ln(Total number of city jobs)	1
WNLnJobTot	Spatial lag of LnJobTot using 1st order queen contiguity matrix	1
Shock	National sector specific employment growth, reweighed according to city sector structure (Katz & Murphy (1992))	3
FrmSize	City average number of employees per firm establishment	3
Unem	Unemployment rate	2
ShLowIncHH	Share of city households with low income	2
LnHousP	ln(City average housing value, relative to national mean)	2
Crime	Crime suspects, per 1000 of the city population	2
Grads	Number of graduates from city university and vocational colleges	4
WCGrads	Spatial lag of Grads using row-normalised commuting matrix	4
Soc/Tech	Social science graduates entering city labour market / technical science graduates entering city labour market	4
WCSoc/Tech	Spatial lag of Soc/Tech using row-normalised commuting matrix	4
GrC/NcJobs	Graduates entering creative jobs in city labour market / Graduates entering non-creative jobs in city labour market	4
WCGrC/NcJobs	Spatial lag of GrC/NcJobs using row-normalised commuting matrix	4
GrC/NCEduc	Graduates with majors in creative fields entering jobs in city labour market / Graduates with majors in non-creative fields entering jobs in city labour market (classification as in Comunian et al (2010))	4
WCGrC/NCEduc	Spatial lag of GrC/NCEduc using row-normalised commuting matrix	4
Data sources		
1	Statistics Netherlands (Labour Survey); AVO; own computations	
2	Statistics Netherlands	
3	LISA Registry of Firms	
4	ROA - SIS, own computations	

This approach minimises the degree of assumed spatial dependency. Rather than assuming that the skills structure is the same for all cities that share the same two-digit postcode, we only assume that the skills structure in a given sector, in a given year, is the same across a two-digit postcode region. In addition, the degree of spatial dependency is likely to be higher in small municipalities. More of these municipalities would share the same two-digit postcode, and as a result would have the same skill

is based on the Dutch version of the international ISCED classification, and is divided into low (ISCED 0 – 2), medium (ISCED 3 and 4) and high (ISCED 5 and 6) levels. The WCS survey under-reports the public sector (government, education). The data were therefore enriched using the ROA-SIS graduate survey from which the skills structure for these NACE sectors was derived at the regional level.

structure assigned to them. Therefore, and for other data-related reasons, we have focussed this study on a subset of the 293 larger municipalities out of the total of 441 (as of January 2009). Our selection is based on cities that had more than 10,000 inhabitants over the entire study period, plus available data. Our approach does not allow an analysis of city employment by sector, as in Blien *et al.* (2006) and Glaeser *et al.* (1992), as the city's skills structure is determined from the sector structure. The sectoral structure is controlled for in our modelling approach.

We use the ROA School-leaver Information System (ROA – SIS) dataset (available for 1997 – 2008) to compute the relative flows of graduates towards a city's labour and housing markets (variable “GrWork/Liv”). However, the inflow of graduates to a city's residential areas could not be based directly on those data because information on residential locations was only included for the period 2005 to 2008. Instead, we applied Statistics Netherlands data on migration by age, selecting only migrants aged 20 to 25 since this covers the age group in which most graduates receive their college and university diplomas. Even though correlations with the available graduate-based information are very high (at around 95%), it is likely to constitute some degree of overestimation of the true graduate flows. However, given the use of the variable within the context of this study (relative attraction to labour and housing markets) this issue is of limited consequence.

Appendix 5.B: 3SLS models - jobs by worker education level / population by education

Table 5.B.1: 3SLS models - jobs by worker's education level / inflow of graduates onto city labour or housing markets (all variables entered for 1998 unless stated otherwise).

	3SLS, model A.L JobShLowEduc ₂₀₀₈	3SLS, model A.M JobShMedEduc ₂₀₀₈	3SLS, model A.H JobShHighEduc ₂₀₀₈
<i>Endogenous variable</i>			
Endog: GrWork/Liv ₂₀₀₈	-3.12 **	-6.72 ***	2.76 *
WCGrWork/Liv	10.27 ***	-1.67	2.55
<i>City stocks of human capital: jobs by worker education level, education level of population, lag of dependent variable</i>			
JobShLowEduc	0.10 ***	0.01	-0.08 **
JobShMedEduc	-0.02	0.14 ***	-0.09 ***
JobShHighEduc	-0.08 **	-0.16 ***	0.17 ***
PopShLowEduc	0.38 ***	-0.05	-0.29 ***
PopShMedEduc	0.13	0.16 *	0.04
PopShHighEduc	-0.51 ***	-0.11 *	0.25 ***
<i>Size of city and surrounding cities</i>			
LnPopTot	-4.62 ***	-0.14	3.10 ***
WNLnPopTot	0.26	-3.69 ***	2.74 ***
<i>City economic control variables</i>			
Shock	1.28	3.77 ***	3.36 ***
FrmSize	1.18	4.77 ***	-0.10 ***
Unem	0.52 *	0.67 ***	-1.15 ***
ShLowIncHH	0.13	0.59 ***	0.46 ***
<i>City amenity control variables</i>			
LnHousP	2.33	13.33 ***	-3.13
Crime	-0.03	-0.36 *	0.03
<i>Presence of colleges and universities, composition of graduate inflow on city labour markets</i>			
Grads	0.94 **	-1.50 ***	1.11 ***
WCGrads	-5.31 ***	3.82 **	6.06 ***
Soc/Tech	0.05	-0.20	0.62 *
WCSoc/Tech	2.22 *	-2.97 **	2.41 *
GrC/NcJobs	-0.10	0.18 *	-0.13
WCGrC/NcJobs	-0.81	1.64 ***	0.10
GrC/NCEduc	-5.53	7.73	3.14
WCGrC/NCEduc	5.48	-17.45	31.88 **
R ²	0.94	0.98	0.96
RMSE	6.60	6.76	6.52
CHI ²	4379.40 ***	12958.38 ***	7865.92 ***

Endogenous variable, lag of dependent variable	GrWork/Liv ₂₀₀₈	GrWork/Liv ₂₀₀₈	GrWork/Liv ₂₀₀₈
Endog. JobSh__Educ ₂₀₀₈			
WCJobSh__Educ	0.00	0.02	-0.01
GrWork/Liv	0.01	0.00	0.00
Size of city and surrounding cities	0.52	0.58	0.52
LnJobTot	0.18	0.19	0.20
WNLnJobTot	-0.05	0.00	-0.03
City economic control variables			
Shock	0.12	0.11	0.22
FrmSize	0.08	0.10	0.14
Unem	0.04	0.03	0.03
ShLowInclH	0.00	0.00	0.01
City amenity control variables			
LnHousP	0.15	-0.06	0.16
Crime	-0.02	-0.02	-0.02
Presence of colleges and universities, composition of graduate inflow on city labour markets			
Grads	-0.08	-0.06	-0.06
WCGrads	0.08	-0.01	0.11
Soc/Tech	0.05	0.06	0.05
WCSoc/Tech	0.06	0.10	0.06
GrC/NcJobs	0.00	0.00	0.00
WCGrC/NcJobs	-0.01	-0.04	-0.01
GrC/NCEduc	0.56	0.41	0.59
WCGrC/NCEduc	-0.17	0.10	0.07
Constant	-0.54	-0.77	-0.60
N	293	293	293
R ²	0.64	0.52	0.57
RMSE	0.30	0.34	0.32
CHI ²	513.62	407.36	473.21
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.	***	***	***

6. Conclusions and discussion

In this chapter we discuss the main findings from this research. We start with a short recap of the research questions in Section 6.1, followed in Section 6.2 by a discussion of the insights that have emerged from our analyses. We conclude in Sections 6.3 and 6.4 with, respectively, the policy implications of this study and then a discussion of the data and methodology applied in this thesis and some suggestions for future research.

6.1 Research goal and research questions

The goal of this study was to gain insights into the main determinants of, and returns on, spatial mobility by graduates of Dutch universities and colleges of higher education. This gave rise to two sets of research questions. The first set dealt with the individual and regional determinants of migration. Firstly, what are the human capital profiles of spatially mobile and non-mobile graduates of colleges and universities in the peripheral areas of the Netherlands? Further, what are the main regional economic and other determinants of graduate migration, and how can recent trends in graduate migration be explained? Secondly, we have studied the returns on migration both at the individual level as well as in terms of the effect on receiving cities. Does spatial mobility lead to a better job-match? How does an inflow of graduates impact on the skills structure of a city and its residential and labour markets?

6.2 Main findings

In Chapter 2, we demonstrated that the transition from study to work results in considerable net flows of graduates from the north, south and east of the Netherlands towards the larger cities located in the NUTS 1 region ‘West’. These net flows are a

concern for policymakers in cities located in what the chapter refers to as the periphery of the Netherlands. In Chapter 2, we therefore studied the spatial mobility of a sample of graduates that have completed their education at a college or university located outside the economic heartland of the Netherlands. We focus on the composition of graduate flows in order to understand to what extent these peripheral regions manage to retain or attract graduates. Specifically, we are interested in the flows in terms of the skills levels of the graduates and their composition in terms of academic discipline. Even though these regions lose a considerable number of their graduates, this does not necessarily mean that they lose their best graduates.

Theoretically, individuals with higher levels of human capital are expected to exhibit higher degrees of spatial mobility. This has been related, for example, to greater information-gathering capacity or to the higher opportunity costs of staying in an unfavourable situation. However, as discussed in Chapter 2, a contrasting view is that local employers select potential workers according to their skills in an effort to minimize training costs. In relatively small regional labour markets, with a limited number of opportunities, this would imply that those with the least skills will be forced to become spatially mobile, as the best graduates take up all the available local positions. This is referred to as a labour queue effect on spatial mobility, compared to the opposing view seen as a human capital effect. In addition to these possible processes, the spatial distribution of job opportunities may vary for graduates with degrees in different academic disciplines. Therefore, one might expect to see different patterns of spatial mobility between graduates with different skill levels and from different academic disciplines.

Our findings indicate that university graduates are more spatially mobile than college graduates. In addition, we find that graduates with higher grades are significantly more likely to go abroad upon graduation. Alongside the effect of graduation grade, moving abroad is strongly linked to the respondent's own nationality: foreign-born graduates are far more likely to work outside the Netherlands. There are also substantial variations in spatial mobility between graduates with different academic disciplines. Graduates in agriculture and economics, both at university and college levels, are by far the most mobile. Graduates in behavioural and social sciences or in healthcare, together with college graduates in teaching and university graduates in natural sciences, are the least mobile.

In general, graduates with higher grades are neither more nor less likely to move to the 'West' region than those with lower grades. However, for college graduates we find the best teaching and healthcare graduates are less likely to leave the Netherlands, and thus we conclude that the labour queue effect dominates for these particular disciplines, at least at the national level. Conversely, the positive interaction

effect found between a high grade and discipline for college graduates in economics points to a human capital effect, with the best students in this discipline more likely to go to the economic centre. For university graduates, we found significant positive interaction effects between grade and subject, with the best economics and law graduates most likely to move to the economic centre. Conversely, we found negative interaction effects between grade and subject for graduates in natural sciences, in terms of the likelihood of a move towards the economic centre. The opposite seems to be the case for university graduates in economics: the positive coefficients indicate that there is a significantly higher probability of the best students moving abroad or moving to the centre. For university graduates in the humanities we found a significant negative effect on working outside the Netherlands, but no significant effect in terms of internal migration. These results indicate that the best humanities students are less likely to leave the country, although they do not necessarily remain in their study region.

Based on Chapter 2, we therefore conclude that there is little evidence that the best graduates necessarily leave the peripheral study regions, as the human capital model of migration would seem to imply. Rather, on the national and even the regional level, the job-competition model would seem to dominate in a number of fields, rather than the human capital model. It is argued that these results provide interesting options for local policymakers and employers. Further, even though there are substantial net flows of graduates towards the core regions of the Netherlands, this does not necessarily imply that employers in peripheral regions are unable to acquire the human capital needed for their businesses.

In Chapter 3, we focus more specifically on regional determinants of graduate spatial mobility. We demonstrate that, over the period 1997 – 2008, college graduates were increasing staying in the province (NUTS 2 region) where they studied, rather than moving to another NUTS 2 region within their wider NUTS 1 region of studies, or to other parts of the country (between NUTS 1 regions). For university graduates, moving abroad has becoming more prevalent over time.

Theoretically, a variety of factors could underpin these patterns. It is assumed that migrants would not have undertaken a potentially costly move unless there is a gain and a premium that offsets the costs. In the literature, these gains are thought of as including both economic factors as well as factors related to amenities and quality-of-life aspects. In various studies it has also been stressed that migration drivers may vary for different age groups. For example, economic factors are found to be particularly important for young school leavers.

In the multivariate analysis in Chapter 3, we found that graduate migration in the Netherlands is predominantly driven by the availability of suitable jobs. A second

structural element, the regional cost of living, was found to be relatively important only for college graduates, whereas the migration of university graduates was found to be driven more strongly by cyclical factors such as regional economic growth rates. From this, it can be concluded that graduate migration in the Netherlands is predominantly structural in nature. Even though the spatial distribution of jobs is hard for individual policymakers in cities and regions to influence, we did find that some regions have, over time, become better at retaining a larger share of their own graduates. Individual factors failed to explain these trends in spatial mobility. After adding regional economic characteristics to the model, the coefficient of the trend parameter was either reduced to insignificance, or changed sign. From this, one concludes that regional economic characteristics are sufficient to explain the observed differences in destination choices. Among the characteristics considered, the availability of a large labour market was especially a key explanatory factor, over and above the effect of housing prices, unemployment rates among recent graduates and the business cycle. Overall, regions that are retaining a higher share of their graduates are doing so as a result of improved regional economic circumstances, among which a sizeable job market seem to be of critical importance.

From Chapters 2 and 3, we conclude that the spatial mobility of graduates is affected by both their human capital and their academic discipline, as well by as the availability of labour market opportunities. In Chapter 4, we investigated the relationship between spatial mobility and the quality of the job-match, whilst controlling for these identified factors. Alongside looking at the effects on hourly wage rate, we aimed to expand the literature by looking at a number of additional job-match indicators. In our analysis, to achieve this, we controlled for unobserved personal characteristics that could introduce endogeneity into the relationship between migration and job-match quality.

Our OLS multivariate analysis of mobility and wages shows, for both college and university graduates, the expected, and in line with many other studies, positive and significant effect of spatial mobility on wages. However, after controlling for self-selection, we find that the positive effects of spatial mobility on the hourly wage rate are no longer significant for university graduates. Worse, for college graduates, we find a negative effect of migration on wage rate. What we did find was evidence of positive selection among college and university graduates: those that have a higher propensity to be mobile, are also more likely to do well in terms of wage rate. We also found strong effects on the wage rate of other human capital indicators entered into the analysis that were consistent with our expectations. While economic theory predicts positive returns on migration, our results seem to indicate that it is a variety of personal and regional factors that are instrumental in achieving this result, not the move as such.

Among the observed characteristics that play a role are graduation grades, participation in extracurricular activities and the scale of the receiving labour market. In addition, we see evidence that factors that we have not observed or measured play a role.

In Chapter 4, we considered the relationship between migration and the wage rate for specific sub-groups within our sample. Firstly, we looked for differences between economics and healthcare graduates since considerable differences in migration propensity had been found for these groups in Chapter 2. We anticipated higher returns for economics graduates since their mobility patterns are largely driven by human capital related factors. However, even though we found a positive effect on the wage rate for university-trained economists in our OLS models, once we had controlled for selection we did not see any remaining effects. For college graduates in economics, a negative effect of mobility on wages was found after controlling for selection. For healthcare graduates, we found no relationship between migration and the wage rate. This was in line with our expectations as, compared to economists, appropriate job opportunities are spread more evenly across the country. For university healthcare graduates especially, migration is likely to be driven more by the training opportunities available in academic hospitals.

In Chapter 4, we also reported on the differences between male and female graduates in terms of job mobility. The literature suggests that, especially for women, spatial mobility is a way of dealing with adverse circumstances in local labour markets. Indeed, in Chapter 2 we had shown that women are more likely than men to leave the peripheral areas of the Netherlands and move towards the opportunity-rich core areas. On these grounds, we expected to find higher returns on migration for women than for men. Although our OLS analysis for university graduates did provide general support this idea, once we had controlled for selectivity we did not find any return on migration for either men or women. We were able to demonstrate that the wage effects of migration reduce to a positive selection effect for male and female college graduates and for female university graduates. This indicates that the favourable effects of migration for these groups are related to unobserved individual characteristics.

In addition in Chapter 4, we analysed the relationship between spatial mobility and a number of alternative job-match indicators that relate to objective characteristics of an employment contract such as hours worked, the length of the contract and the extent of horizontal (level) and vertical (field) matching between education and the skills required for the job, as well as more subjective evaluations of the match between education and job. The evidence is slightly more mixed than for wages although we again found that controlling for selectivity reduces the observed returns on migration. For some job-match indicators, negative returns on migration are found; in other cases,

a relationship that is initially positive is rendered insignificant after controlling for self-selection.

Negative returns on migration suggest that some job-match aspects are affected by forced migration or that migration is driven by motivations not directly related with labour market outcomes, such as household situation or amenities in the destination region. This would explain the somewhat counterintuitive negative effects of migration on wages that we found for some of the college graduates, and also the negative effects found for some of the other job-match measures. Conversely, we found for university graduates that constraints on migration did affect some job-match aspects negatively: negative selection effects appear to reduce the likelihood of finding a full-time job and limit looking for another job. Although the selection parameter was not significant in these models, the migration coefficient in the simple probit models appeared biased downwards.

Human capital promotes regional growth through innovation and learning, especially in densely populated urban regions where interactions are more frequent. Even though the presence of human capital has been shown to have positive effects on regional growth in the empirical literature, little is known on how these effects materialize. Should local policymakers focus on creating attractive residential areas, on labour market opportunities, or on both? Potentially, human capital spillovers will mainly occur at the workplace as a result of learning and knowledge transfers within firms. However, spillovers between skill levels may also occur through inhabitants spending and using city facilities, i.e. through consumption. In Chapter 5, we attempted to shed light on this aspect by studying the relationship between a city's skills structure and the inflow of graduate human capital to its labour and housing markets. We carefully distinguished between the stocks of human capital residing as against working in a city. Effects resulting from inflows related to the labour market are considered as production spillovers, whereas effects found for residence-related inflows are interpreted as consumption spillovers. An initial question was were there only effects for the higher skilled, or do other groups also benefit? Furthermore, did graduate human capital inflows have a significant effect over and above the effect of existing city endowments of human capital, and the effects of neighbouring areas?

We found positive spillovers for the inflow of individuals with high human capitals on both the labour and the housing markets. A relatively strong inflow into a city's labour markets leads to an improved position in terms of jobs for which a scientific skill level is required, indicating a productivity spillover for this group. Alongside this, the share of lower and medium level jobs improves in cities with a relatively strong inflow into city residential markets. This supports the view that there are positive consumption spillovers in Dutch cities.

However, graduate inflows do not only cause changes in the city skill structure; they are also influenced by the existing structure. From our analysis in Chapter 3, it became clear that graduates move to regions that provide more attractive labour market opportunities. In Chapter 5 this was confirmed as we found that graduate human capital inflows to the labour market are mainly driven by market size effects, for example the presence of a large number of jobs in the city or in the immediate vicinity, or the presence of large firms. The presence of colleges, universities and higher proportions of workers in higher and scientific level jobs is also shown to promote affect residential inflows of graduates. This somewhat counterintuitive result can be explained by graduates that remain in their university or college city whilst looking for work in that city or within reasonable commuting distance.

In Chapter 5 we carefully distinguished between the stocks of human capital residing and working in a city. We demonstrated that both types of stock simultaneously influence the city's skills structure, either through production effects (changes to the stock of jobs by skills level) or through consumption (resident population by education) effects. We however found little evidence of positive spillovers between skill groups, with the main effect being to strengthen the position of one's own skills group. The positive consumption effect on the lower and medium skilled workers, of an inflow of recent graduates, is an exception in that sense. We have also considered relevant neighbouring areas to a city, and found some spatial spillover effects on the city's skills structure, which appear to affect different skill groups in different ways. Having large neighbouring cities has positive effects for the higher skill groups but results in negative effects for the medium skill groups. The presence of colleges and universities in neighbouring cities within commuting distance also serves to increase the level of skills in a city.

6.3 Implications for policy

In this research, we have studied both the determinants of graduate spatial mobility as well as the individual and regional returns. Local policymakers currently pay considerable attention to attracting and retaining graduates in their regions. As Chapter 5 demonstrates, there is good reason to focus on this group: there are returns in terms of city development through production and consumption spillovers, not only for the highly skilled but also for less-skilled workers. However, as was shown in Chapters 2, 3 and 5, graduates are attracted to regions with sizeable labour markets and there are considerable net flows of graduates towards the larger cities in the western part of the Netherlands. This is a potential disadvantage for cities located in regions with less dense economic activities. However, this thesis demonstrates that there is scope for

policymakers in these areas to devise appropriate policies, and these policies should focus on specific groups or specific frictions in the regional economy.

Firstly, we have demonstrated that even if peripheral areas do not retain the majority of local graduates, they do manage to retain the better graduates in some disciplines. This is an indication that some local employers are able to recruit the high-level human capital that they require, leaving other graduates to look for opportunities elsewhere. Secondly, we have shown in Chapter 3 that, over the last decade, some peripheral areas have managed to retain an increasing proportion of college graduates as a result of improved economic circumstances. These results show that peripheral areas do have a role to play in the retention of specific groups of graduates. Thirdly, if migration away from college and university towns consistently leads to an improvement in the quality of graduate job-matches, as is often the case, this could be an indication of structural problems in the local labour market. However, we have demonstrated that these positive returns on migration hinge not so much on the move after graduation as such, but rather are an outcome of observed and unobserved characteristics of the graduates. These qualities determine both spatial mobility and the positive labour-market outcome. Fourthly, we have shown how cities of different sizes, and with various positions in the urban hierarchy, from large employment centres to smaller cities with stronger residential qualities, stand to gain from an inflow of graduates. Our results show that cities that do not have especially attractive labour market opportunities, in comparison to the larger cities, can still gain from residential inflows, often as a result of them being within commuting distances of larger centres in this densely populated country.

These insights imply that there should be different focusses for policymakers in large and smaller cities. Large net graduate outflows are not an indication of structural problems in regional labour markets as such and the focus should not be on these net gains or losses, but rather on specific frictions in labour markets that arise as a result of outmigration or failure to attract graduates with specific desired qualifications. It is important to understand the relationship between the skills needed in the local labour market and the academic programmes taught at local institutions of higher education. Programmes that are not embedded in the regional economy are likely to see greater outmigration rates by graduates. On the other hand, given that higher educated individuals are highly spatially mobile, deficiencies in certain locally needed skills can also be relatively easily imported from elsewhere, given the willingness of high quality graduates to move for an attractive job.

For individual graduates, constraints on migration or a lack of opportunities can lead to inferior outcomes on the labour market. Constraints on migration or reasons for ‘forced’ migration may be related to regional labour queue effects as described earlier,

but also to factors outside the labour market, such as amenities or household situations. Different groups are affected in different ways. These findings illustrate the need to gain insights into migration drivers for individuals and households at each stage of the life course. Policies aimed at attracting or retaining graduates need to take a broad perspective into account, and not just focus on what is admittedly the key determinant: the availability of jobs. Based on the results in Chapter 5, it should be noted that factors that have traditionally been thought of as affecting residential qualities may also affect the local labour market, and vice versa.

Further, from Chapter 4 it can be concluded that previous mobility is a key predictor of future mobility. This implies that graduates that hail from the regions they receive their degrees in are more likely to remain in that region for employment. Conversely, graduates that covered relatively large distances to attend a college or university are also the more likely to leave after graduation. Graduate retention may be served by creating an awareness of the region's employment opportunities before students move into higher education, in the region or elsewhere, as this would build on the apparent patterns of repeated migration.

6.4 Discussion and suggestions for further research

In this section we reflect on a methodological aspect, as well as the dataset that was applied in this thesis. A wide variety of techniques was applied throughout the thesis, ranging from multinomial logit models in Chapters 2 and 3, OLS, treatment-effect regression and bivariate probits in Chapter 4 and a three stage least squares (3SLS) approach in Chapter 5. A common feature of the analyses in Chapters 2, 3 and 4 was the inclusion of variables at both the individual as well as the regional level. Whereas in Chapters 2 and 4 these variables served as mere controls, in Chapter 3 we attempted to make a more specific inference on how regional circumstances impact on spatial mobility of individual graduates. It is of great importance to recognise that the significance of these inferences can easily be overstated if the spatial mobility of graduates hailing from the same regions of study is positively correlated, for reasons not observed by the researcher. Snijders and Bosker (2004) discuss this issue from the perspective of sampling theory and multilevel modeling. In the literature cluster-robust standard errors are often applied in order to deal with these potential intra-group correlations. This method prevents over-rejection of the hypothesis that the coefficients of variables at the group-level are zero, in a situation of positive intra-group correlation. In what follows, we briefly discuss this issue for the example of Chapter 3.

Careful consideration of the correct levels at which to cluster is required. In the case of Chapter 3, one such level would be the province of studies – this is the level at which the regional economic variables are measured. Also, if intra-group correlations of migration outcomes are an issue, they are likely to be shared by graduates that completed their degrees in areas that share the same circumstances. A second dimension at which intra-group correlations potentially play a role is the year of observation. Unobserved time-specific shocks may lead to correlations between graduates who completed their programmes in the same year. Including variables at the level of regions or time periods, or applying fixed effects techniques, in a model may partially serve to deal with these issues, but leaves open the possibility that intra-group correlations are not fully dealt with.

Cameron *et al.* (2006) propose an estimation method for these two-way non nested clusters. Essentially, this involves separately estimating the effects of the two dimensions and subtracting the common variance. The authors also note however, that both clusters need to consist of a sufficient number of groups - i.e., provinces and time periods, in the case of Chapter 3, as the approach relies on asymptotics. A commonly applied rule of thumb is that a cluster size of a minimum of fifty groups is sufficient (Kézdi, 2004). The analysis in Chapter 3 is based on twelve provinces in the case of college graduates and eight provinces in the case of university graduates. Moreover, our dataset provides us with twelve and ten years of data for these two groups, respectively. This is prohibitive in terms of applying the required two-way non-nested clusters.

The second best alternative, clustering on a one-way variable indicating membership of graduates of a specific “province-time” group, is theoretically less desirable as it only controls for correlations between graduates within those specific groups, and does not hold for correlations between graduates from the same regions across time periods, for example. As this one-way approach does provide us with enough groups to estimate cluster-robust standard errors with, we re-ran the models reported in Tables 3.5 and 3.6, using these province-time clusters. The results, which are available upon request, show the same coefficient values and marginal effect sizes as reported in Chapter 3. However, as expected, the significance level of a number of the regional variables decreases, with some turning insignificant. These are typically the coefficients for which small effect sizes were reported in Tables 3.5 and 3.6 in Chapter 3. Applying cluster-robust standard errors at the level of province-time however did not impact on the main results in Chapter 3 – next to a number of secondary factors the availability of jobs remains the key driver of graduate spatial mobility.

We turn to a discussion of the data employed in this thesis. The analysis in this thesis is based on data from the annual School-leaver Survey by the Research Centre for Education and the Labour Market, University of Maastricht, the Netherlands. From this dataset, we selected college and university graduates who had participated in full-time education and were not older than 30 years at the time of graduation. In the Survey, graduates are tracked and interviewed approximately 18 months after graduation on topics related to their period in higher education and their current employment. In this thesis, data from 1997 to 2008 were used, with some chapters focussing on a subset of the available years due to data limitations with some of the variables only available for sub-periods. The dataset provides a rich and representative insight into the first steps onto the labour and housing markets for these eleven consecutive graduation cohorts. Naturally, the dataset has its limitations and some topics that would have been interesting and relevant have remained beyond the scope of this thesis. In what follows, we will briefly discuss these issues and the extent to which they form an agenda for future research.

Firstly, we have studied labour market outcomes and spatial mobility approximately eighteen months after graduation. Our results indicate that this period is sufficient to encompass the process of completing the transition from college or university to working life and the ensuing spatial movement. There is however reason to believe that the patterns reported in this thesis would change if the observation window were to be extended to several more years beyond graduation. Careers progress as graduates start moving from their first job to other jobs, reflecting horizontal and/or vertical mobility within the labour market. This could again lead to spatial mobility. It may also lead to a weakening of the link between academic discipline and one's job, and the spatial mobility that is required to achieve a good match between these two aspects. In this light, future research could usefully focus on subsequent spatial mobility and labour market dynamics. For individual cities, such a study could shed light on the question as to whether the local labour market is able to provide sufficient opportunities for more experienced workers, alongside graduates starting a career. Also, as we move further away from graduation, preferences regarding housing and labour market arrangements may change. Potentially, household formation processes may start to play a more prominent role. The presence of a partner and children often requires compromises which may render an initial location decision suboptimal. We were not able to include household situation as a factor in this analysis due to lack of data. Future research should consider this life course dimension.

Secondly, we have focussed our analysis on labour market outcomes for the complete sample of graduates under study. As such, we have not specifically focussed on the subgroup labelled entrepreneurs. However, much policy effort is directed at

stimulating graduate entrepreneurship, for example through what are commonly referred to as “incubators” that are directly linked to local institutions of higher education. Future research could focus on patterns of spatial mobility for such graduates, as this may provide useful insight into the local efficacy of such stimulation policies. Entrepreneurs may be found to exhibit stronger regional links than the average graduate since local networks can be instrumental in generating company growth.

Thirdly, we have ignored those students that drop out of higher education before graduating. This particular group may be highly selective, in the sense that they could be expected to do rather worse in terms of labour market outcomes. Nevertheless, some may have dropped out as a result of a successful side-activity, for example entrepreneurship, which increased the opportunity cost of time spent in college or university to unacceptable levels. Identification of such groups and their performance could provide policymakers with valuable input regarding possible labour market transition programmes.

Fourthly, our dataset did not allow a detailed analysis of graduates moving to and from other countries, beyond the use of the control variables entered in the models in various chapters. As such, a potentially insightful extension would be a comparative study in a European perspective. In a wider view, flows of knowledge workers to and from the upcoming BRIC (Brazil, Russia, India and China) countries could prove interesting. This thesis has shed light on the ability of regions to retain and attract graduates from Dutch institutions of higher education, but forging relationships with regions located in the wider Europe and beyond, through the exchange of human capital, could prove essential for sustainable growth.

References

- Cameron, A.C., J.B. Gelbach and D.L. Miller (2006) *Robust inference with multi way clustering*. NBER Technical Working Paper 327, National Bureau of Economic Research, Cambridge, MA, USA.
- Kézdi, G. (2004) *Robust Standard Error Estimation in Fixed-Effects Panel Models*. Hungarian Statistical Review Special (9), pp. 96-116.
- Snijders, T.A.B. and R.J. Bosker (2004) *Multilevel Analysis; An introduction to basic and advanced multilevel modeling*. Sage Publications, London, U.K.

7. Samenvatting in het Nederlands

ABSTRACT - In dit proefschrift staat de ruimtelijke mobiliteit van recent afgestudeerden van Nederlandse universiteiten en hbo-instellingen centraal. De aanwezigheid van hoger opgeleiden kan gunstige effecten hebben op de economische ontwikkeling van regio's. Er is dan ook veel aandacht van beleidsmakers en wetenschappers voor de locatiekeuzes van deze zeer mobiele groep hoger opgeleiden. In dit proefschrift wordt eerst ingegaan op de individuele en regionale determinanten van ruimtelijke mobiliteit. Zo wordt aangetoond dat er grote verschillen zijn in vertrekkans uit het noorden, oosten en zuiden van Nederland tussen studenten met verschillende afstudeerrichtingen. Het zijn daarnaast niet automatisch de beste studenten die deze zogenoemde periferie verlaten. De aanwezigheid van ruime mogelijkheden op de arbeidsmarkt is de belangrijkste factor in de locatiekeuze. Daarnaast worden de opbrengsten van ruimtelijke mobiliteit voor de individuele afgestudeerde en voor de ontvangende stad bestudeerd. Uit dit proefschrift blijkt dat ruimtelijk mobiele afgestudeerden gemiddeld genomen een kwalitatief betere baan hebben. Dit wordt echter niet veroorzaakt door mobiliteit als zodanig, maar door persoonlijke kenmerken die zowel ruimtelijke mobiliteit als het vinden van een goede baan verklaren. Instroom van recent afgestudeerden op stedelijke arbeidsmarkten heeft gunstige effecten op de aanwezigheid van wetenschappelijke banen in de stad. Van instroom van afgestudeerden op de stedelijke woningmarkt gaan positieve consumptie effecten uit op banen van lager en middelbaar niveau. Dit proefschrift resulteert in voor wetenschap en beleid belangwekkende inzichten in ruimtelijke mobiliteit van afgestudeerden, naast enkele suggesties voor toekomstig onderzoek.

7.1 Achtergrond van deze studie

Er is veel aandacht in de literatuur voor aanhoudende verschillen in economische groei tussen regio's en landen. Auteurs als Romer (1986, 1990) en Lucas (1988) stellen dat de aanwezigheid van menselijk kapitaal ("human capital", Becker, 1964) hier een cruciale rol in speelt. Menselijk kapitaal is in de loop van de tijd op uiteenlopende wijze gedefinieerd (Faggian en McCann, 2009). Algemeen gesteld gaat het bij dit

concept om de vaardigheden die men in het onderwijs, door werkervaring, of op andere wijze opdoet. Er zijn zowel privé als publieke of sociale opbrengsten van menselijk kapitaal te verwachten. De sociale opbrengsten uiten zich bijvoorbeeld in leereffecten: daar waar men samenwerkt met anderen die bepaalde vaardigheden bezitten kan overdracht van die kennis leiden tot een toename van productiviteit. Lucas (1988) stelt op grond van dergelijke processen dat arbeid zich zal bewegen naar gebieden waar een relatief hoge concentratie van menselijk kapitaal aanwezig is. De arbeidsproductiviteit hangt immers samen met de aanwezigheid van andere vaardige werknemers. De leereffecten leiden tot hogere lonen in dergelijke regio's en hebben een aanhoudende instroom van arbeid tot gevolg.

Naar aanleiding van deze theoretische bijdragen zijn er veel studies verschenen die zich richten op de rol van menselijk kapitaal in regionale en stedelijke economische groei. Ten eerste zijn er studies die zich richten op het meten van de sociaal-economische effecten van menselijk kapitaal, bijvoorbeeld banengroei of inkomensstijging (Duranton en Puga, 2004, Moretti, 2004a, 2004b, 2004c). Een tweede groep studies houdt zich bezig met het microniveau van de individuele vaardige werknemer. Welke locatiekeuzes worden er gemaakt? Zijn het vooral de werknemers met betere vaardigheden die veel verhuizen? Trekken deze werknemers inderdaad naar die gebieden die economisch de meeste kansen bieden? Wat zijn vervolgens de private opbrengsten van ruimtelijke mobiliteit? Voorbeelden van dergelijke studies zijn Fielding (1992), Berry en Glaeser (2005), Détang-Dessendre et al. (2004) en Lehmer en Ludsteck (2011).

Mensen met een hogere opleiding vertonen een hogere mate van ruimtelijke mobiliteit. Faggian en McCann (2009) geven een overzicht van redenen hiervoor. De opportuniteitskosten van een aanhoudend verblijf in een inferieure situatie spelen hier bijvoorbeeld een rol in. Wanneer er sprake is van structurele in- of uitstroom van werknemers met een hoog menselijk kapitaal kunnen er effecten op de groeikansen van de regio zijn (Nijkamp en Poot, 1998).

Daarmee is kennis over de wijze waarop deze werknemers locatiekeuzes maken dus cruciaal voor beleidsmakers. In de literatuur worden twee groepen van factoren onderscheiden die bij locatiekeuzes van belang zijn. Ten eerste zijn er bepaalde omgevingswaarden die van belang worden geacht, zoals de aanwezigheid van natuur en andere “niet verhandelbare” kenmerken van de regio (Graves en Linneman, 1979). Ten tweede zijn er overwegingen die meer economisch van aard zijn, zoals de kans op een goede match op de arbeidsmarkt. Welke groep factoren de ontwikkeling in steden en regio's het best verklaart is een onderwerp van discussie (Storper en Scott, 2009, Partridge, 2010). Echter, onder andere Plane (1993) en Whisler et al (2008) laten zien dat verhuismotieven aanzienlijk kunnen verschillen

tussen bevolkingsgroepen die zich in verschillende levensfasen bevinden. Economische motieven spelen bij recent afgestudeerden een belangrijker rol dan bij diegenen die zich in een latere levensfase bevinden (Gottlieb en Joseph, 2006).

Recent afgestudeerden staan specifiek in de belangstelling van zowel de wetenschap als beleidsmakers. Zij vertonen een hoge mate van ruimtelijke mobiliteit wanneer ze, vlak na het voltooien van een opleiding aan een instelling voor hoger onderwijs, op zoek gaan naar een goede match op de arbeidsmarkt. Wanneer een regio in staat is substantiële aantallen van deze afgestudeerden aan te trekken of vast te houden, kan dit bijdragen aan de basis van menselijk kapitaal in die regio en daarmee aan het vergroten van de lange-termijn groeiperspectieven. Er is dus ook veel aandacht van Nederlandse stedelijke beleidsmakers voor deze groep (Venhorst et al., 2011)

In dit proefschrift staat daarom de ruimtelijke mobiliteit van recent afgestudeerden van Nederlandse instellingen voor hoger onderwijs centraal. Met ruimtelijke mobiliteit wordt in dit proefschrift bedoeld de afstand tussen de locatie van de kennisinstelling en de locatie van de baan. In hoofdstuk 5 bestudeer ik daarnaast ook de locatie van de woning. De aanwezigheid in regio's van, en de aantrekkingskracht van regio's voor werknemers met een hoog menselijk kapitaal is van belang voor de lange termijn perspectieven van deze regio's. Recent afgestudeerden staan daarbij, gezien hun levensfase en de (ruimtelijke) keuzes die daarbij gemaakt worden, in de belangstelling van beleidsmakers. Er is echter nog onvoldoende kennis van enerzijds de factoren die locatiekeuzes van deze groep bepalen en anderzijds de individuele en sociale opbrengsten die er van deze migratie bewegingen te verwachten zijn. Dit leidt tot twee groepen onderzoeksdoelstellingen voor dit proefschrift. Ten eerste onderzoek ik in dit proefschrift wie er vooral een hoge mate van ruimtelijke mobiliteit vertonen en welke persoonlijke en regionale factoren hierin een rol spelen. Deze analyses zijn beschreven in hoofdstukken 2 en 3. Ten tweede onderzoek ik in hoeverre ruimtelijke mobiliteit leidt tot een betere baan voor het betrokken individu en of er effecten zijn op de ontvangende stad. Van deze analyses is verslag gedaan in hoofdstukken 4 en 5. In de volgende paragraaf vat ik de belangrijkste resultaten uit dit proefschrift samen. Vervolgens beschrijf ik een aantal implicaties voor het beleid. Tenslotte doe ik een aantal suggesties voor toekomstig onderzoek.

7.2 Belangrijkste resultaten

In hoofdstuk 2 laat ik zien dat in er in Nederland sprake is van aanzienlijke netto stromen van afgestudeerden vanuit de landsdelen noord, oost en zuid, naar het landsdeel west. Universitair afgestudeerden vertonen daarbij een beduidend hogere

mobiliteit dan afgestudeerden van hbo-instellingen. Deze stromen van afgestudeerden zijn een bron van zorg bij beleidsmakers in steden gelegen in de meer perifere gebieden van Nederland. In hoofdstuk 2 richt ik mij dan ook specifiek op de vertrekkansen van afgestudeerden van universiteiten en hbo-instellingen gelegen in de landsdelen noord, oost en zuid. In dit hoofdstuk concentreer ik mij op de individuele kenmerken van de afgestudeerden. De werkgelegenheid naar bedrijfssector concentreert zich in sommige gevallen in een beperkt aantal steden, zoals de financiële sector, terwijl er in andere gevallen sprake is van een meer homogene ruimtelijke spreiding, zoals bij scholen en ziekenhuizen. Dit gegeven zou zich kunnen vertalen in de vertrekkansen van studenten met verschillende afstudeerrichtingen. Daarnaast bestudeer ik de relatie tussen ruimtelijke mobiliteit en afstudeercijfer. Het “human capital” model van migratie voorspelt dat diegenen met het hoogste niveau aan menselijk kapitaal de hoogste mate van ruimtelijke mobiliteit vertonen. Echter, lokale werkgevers zijn wellicht in staat de betere studenten “uit de collegebankjes” te werven. Indien er op de lokale arbeidsmarkt te weinig mogelijkheden zijn voor alle afgestudeerden, zou een dergelijk proces vertrek van juist de afgestudeerden met gemiddeld wat lagere cijfers te zien kunnen geven.

Uit hoofdstuk 2 blijkt dat er grote verschillen zijn in de vertrekkans van afgestudeerden van verschillende afstudeerrichtingen. Economen en studenten landbouwwetenschappen zijn het meest mobiel. Bij de hbo afgestudeerden zijn PABO studenten het minst ruimtelijk mobiel. Natuur- en gedragswetenschappers zijn, naast de studenten geneeskunde, bij de universitair afgestudeerden het minst ruimtelijk mobiel. Studenten met hoge cijfers zijn niet meer of minder geneigd om in het westen te gaan werken. Echter, uit de analyse komt naar voren dat het juist de betere economie- en rechtenstudenten zijn die een verhoogde kans op mobiliteit vertonen. De betere PABO studenten en afgestudeerden hbo-verzorging hebben, samen met universitaire natuurwetenschappers juist een lagere vertrekkans. Uit hoofdstuk 2 blijkt dus dat niet automatisch de betere studenten naar het westen vertrekken, vanuit de meer perifere gebieden in Nederland.

In hoofdstuk 3 verleg ik de focus naar de regionale determinanten van locatiekeuze van afgestudeerden. In de jaren 1997 tot 2008 blijven hbo-afgestudeerden steeds vaker werken in de regio van hun studie. Dit gaat ten koste van de vertrekkans naar andere landsdelen. In dezelfde periode wordt werken in het buitenland steeds populairder onder universitair afgestudeerden. Vanuit theoretisch oogpunt zal men vanwege materiële en psychologische kosten niet gaan migreren, tenzij er een bepaalde mate van netto opbrengst uit te halen is. Een dergelijke opbrengst kan economisch van aard zijn, maar ook bestaan uit een verbetering in de meer algemene leefomstandigheden zoals een verhuizing naar een aantrekkelijker gebied. In hoofdstuk

3 probeer ik de gevonden trends te verklaren aan de hand van een aantal regionale karakteristieken. Sommige daarvan geven structurele verschillen tussen regio's weer, zoals de omvang van de arbeidsmarkt en de relatieve waarde van woningen als maatstaf voor de woonaantrekkelijkheid van de regio. Andere zijn meer cyclisch van aard, zoals de regionale economische groei of het werkloosheidspercentage onder recent afgestudeerden.

Uit de analyse in hoofdstuk 3 blijkt dat de aanwezigheid van geschikte banen de belangrijkste verklaring biedt voor de locatiekeuze van afgestudeerden. Daarnaast zijn de gemiddelde huizenprijzen van belang voor de locatiekeuze van hbo-afgestudeerden. Voor de universitair afgestudeerden speelt de regionale economische groei een rol. Een eerste belangrijke conclusie uit hoofdstuk 3 is daarmee dat de ruimtelijke mobiliteit vooral gedreven wordt door structurele verschillen tussen regio's, waarbij vooral de aanwezigheid van geschikte banen van belang is. Het zijn ook de structurele, economische verschillen tussen regio's die de eerder beschreven trends verklaren, zo blijkt uit hoofdstuk 3. Uit de resultaten is op te maken dat regio's die het economisch beter zijn gaan doen, meer afgestudeerden vasthouden en aantrekken.

In hoofdstukken 4 en 5 verleg ik de focus van de determinanten van ruimtelijke mobiliteit naar de uitkomsten ervan. In hoofdstuk 4 bestudeer ik of ruimtelijke mobiliteit betere uitkomsten op de arbeidsmarkt tot gevolg heeft: hebben relatief mobiele afgestudeerden betere banen? In het hoofdstuk hanteer ik een brede definitie van wat onder een "betere uitkomst" wordt verstaan. Naast het uurloon kijk ik naar baankenmerken als het aantal gewerkte uren en het niveau of het gevraagde vakgebied van het werk. Ook kijk ik naar subjectieve evaluaties van de baan: is de afgestudeerde tevreden over de match tussen opleiding en werk? Daarnaast bestudeer ik of de afgestudeerde op het moment van onderzoek op zoek is naar ander werk.

In de analyse pas ik een uitgebreide set verklarende variabelen toe, op zowel individueel als regionaal niveau. Deze variabelen corrigeren echter niet voor een selectie- probleem dat een rol kan spelen bij dergelijke analyses. De gemeten relatie tussen ruimtelijke mobiliteit en baankwaliteit kan verstoord worden doordat de kans op mobiliteit en de baanuitkomst met elkaar samenhangen: wanneer de kans groot is dat ruimtelijke mobiliteit geen voldoende resultaat oplevert, zal de potentiële migrant immers niet vertrekken. Daarmee kan het effect van ruimtelijke mobiliteit op de baankwaliteit overschat worden: we meten alleen de successen.

In hoofdstuk 4 voer ik de analyse eerst uit zonder rekening te houden met dit selectie effect. Ik schat OLS modellen voor het uurloon en probit modellen voor de diverse alternatieve baankenmerken. Uit die analyse blijkt het verwachte positieve

effect van migratie op een breed scala aan baankenmerken, voor zowel hbo als universitair afgestudeerden. In een tweede stap houd ik rekening met het eerder beschreven selectie effect, door expliciet de correlatie tussen enerzijds de migratiebeslissing en anderzijds de baankenmerken mee te nemen. Uit deze analyse blijkt vervolgens dat het positieve effect van migratie op de kwaliteit van de baan voor nagenoeg alle kenmerken verdwijnt of zelfs negatief wordt. Hieruit is te concluderen dat het succes van mobiliteit vooral afhangt van (niet-) geobserveerde persoonskenmerken en niet zozeer van de ruimtelijke mobiliteit als zodanig.

Ik voer dezelfde analyse vervolgens ook uit voor een aantal afzonderlijke groepen. Ik vergelijk studenten van verschillende studierichtingen met elkaar, en ik bestudeer de verschillen tussen mannen en vrouwen. De vergelijking tussen afgestudeerden economie en afgestudeerden medische wetenschappen illustreert de resultaten die ik in hoofdstuk 2 laat zien. De verschillen in ruimtelijke mobiliteit vertalen zich ook in de opbrengst ervan, waarbij voor afgestudeerden in medische wetenschappen ruimtelijke mobiliteit geen enkele rol lijkt te spelen in de kwaliteit van de baan. Onder afgestudeerden in de economische wetenschappen spelen selectie effecten en menselijk kapitaal een belangrijker rol. In hoofdstuk 2 blijkt dat vrouwen een hogere kans hebben op mobiliteit vanuit de periferie richting het westen. In hoofdstuk 4 onderzoek ik of dit ook gevolgen heeft voor de opbrengst van mobiliteit voor vrouwen. In de eerste stap, waarin ik geen rekening houd met selectie effecten, blijkt mobiliteit universitair afgestudeerde vrouwen inderdaad een beter uurloon op te leveren. Dit blijkt echter, net als bij de mannen, opnieuw een selectie effect: de verbeterde kwaliteit van de baan wordt vooral veroorzaakt door niet-geobserveerde persoonlijke kenmerken.

In hoofdstuk 5 verleg ik mijn aandacht naar de effecten van de instroom van recent afgestudeerden op de stedelijke economische structuur. De aanwezigheid van menselijk kapitaal in regio's kan positieve gevolgen hebben voor de ontwikkeling van die regio's. Theoretisch gezien zijn deze effecten het sterkst in een stedelijke omgeving, waar leereffecten en samenwerking door de hogere dichtheid van activiteiten beter tot hun recht komen. Deze processen kunnen positieve gevolgen hebben voor zowel hoger als lager opgeleiden. Er is echter nog onvoldoende bekend hoe deze processen hun uitwerking op de stedelijke economie hebben. Naast leereffecten en voordelen uit samenwerking, die ik in hoofdstuk 5 karakteriseer als productiviteitseffecten, kunnen er zich immers ook consumptie effecten voordoen (Sassen, 2001). Deze consumptie effecten kunnen ook werkgelegenheidseffecten hebben. In dat licht is een relevante vraag voor beleidsmakers of zij zich specifiek moeten richten op de instroom van recent afgestudeerden op de stedelijke arbeidsmarkt, met het oog op mogelijke productiviteitseffecten. Of is het beter zich te

richten op instroom van afgestudeerden op de stedelijke woningmarkten, gezien de mogelijke consumptie effecten?

Uit mijn analyse in hoofdstuk 5 blijkt dat zowel productie- als consumptie effecten zich voor doen. Een relatief sterke instroom van recent afgestudeerden op de stedelijke arbeidsmarkt leidt tot een hoger aandeel wetenschappelijke banen in de stad. Tegelijkertijd leidt een relatief sterke instroom van recent afgestudeerden op de stedelijke woningmarkten tot een betere positie van banen waarvoor een lager en middelbaar vaardighedenniveau is vereist. De instroom van recent afgestudeerden op de arbeidsmarkt wordt op haar beurt beïnvloed door schaalgrootte, zoals de aanwezigheid of nabijheid van banen of de aanwezigheid van grote bedrijven. Dit bevestigt de resultaten uit hoofdstuk 3. De instroom van recent afgestudeerden op de woningmarkt wordt onder meer beïnvloed door de aanwezigheid van universiteiten en hbo-instellingen. Dit kan verklaard worden door recent afgestudeerden die vanuit een woning in de oude studiestad op zoek zijn naar werk; men lijkt de woonlocatie vertraagd aan te passen aan de locatie van een nieuwe baan.

7.3 Implicaties voor het beleid

In dit proefschrift heb ik zowel de determinanten als de uitkomsten van ruimtelijke mobiliteit van recent afgestudeerden onderzocht. Er is veel beleidsaandacht voor deze groep, en met reden zoals de resultaten uit hoofdstuk 5 laten zien. Uit de resultaten blijkt dat de ruimtelijke mobiliteit van afgestudeerden voor een belangrijk deel bepaald wordt door structurele verschillen tussen regio's. Dit zou tot de conclusie kunnen leiden dat er maar beperkte ruimte is voor beleid. Echter, de resultaten laten ook zien dat ook perifere regio's er nu al in slagen geschikte afgestudeerden vast te houden en te werven. Daarnaast verschillen de uitkomsten van ruimtelijke mobiliteit tussen personen. Hier kunnen aangrijpingspunten voor beleid liggen, gericht op bepaalde groepen, op het oplossen van fricties op de lokale arbeidsmarkt of het aantrekkelijk maken van de woningmarkt.

Ten eerste blijkt uit de analyse dat perifere gebieden weliswaar niet alle, maar gemiddeld wel de betere studenten in een aantal disciplines vast te houden. Dit geeft aan dat lokale werkgevers er in slagen gemiddeld de betere studenten te werven, waarbij de overige afgestudeerden in die studierichtingen hun heil elders moeten zoeken. Ten tweede blijkt uit hoofdstuk 3 dat sommige regio's tussen 1997 en 2008 een groter deel van hun afgestudeerden vast zijn gaan houden, ten gevolge van verbeterde economische omstandigheden. Deze resultaten laten zien dat perifere regio's wel degelijk afgestudeerden aantrekken. Ten derde, wanneer ruimtelijke mobiliteit altijd zou leiden tot een verbetering in de kwaliteit van de gevonden baan,

zou dit een indicatie kunnen zijn van structurele problemen op de lokale arbeidsmarkt. Uit hoofdstuk 4 blijkt echter dat de persoonlijke opbrengsten van ruimtelijke mobiliteit vooral bepaald worden door geobserveerde en niet-geobserveerde persoonlijke kenmerken. Ten vierde is gebleken dat zowel steden met een sterk arbeidsmarktprofiel als steden met een sterkere focus op woonkwaliteiten voordeel kunnen hebben aan de instroom van recent afgestudeerden.

Deze resultaten impliceren een andere focus voor beleidsmakers, in zowel grote als kleinere steden. Een aanzienlijke netto uitstroom van recent afgestudeerden hoeft als zodanig geen indicatie van een structureel probleem op de lokale arbeidsmarkt te zijn. De focus zou dan ook niet moeten liggen op het bestrijden van deze uitstroom als zodanig, maar op het identificeren van specifieke fricties op de lokale arbeidsmarkt. Het is van belang inzicht te verkrijgen in de verhouding tussen enerzijds de door het lokale bedrijfsleven gevraagde vaardigheden en anderzijds het aanbod van hoger opgeleiden naar academische discipline van lokale kennisinstellingen. Studieprogramma's die weinig relatie vertonen met de regionale economie kunnen hogere uitmigratie te zien geven. Tegelijkertijd, gegeven de hoge mate van ruimtelijke mobiliteit van recent afgestudeerden, kunnen eventuele deficiënties in het lokale aanbod van opleidingen ook worden opgelost door gericht van elders te werven, gezien het belang van het aanbod van geschikte banen in de locatiekeuze van recent afgestudeerden.

Op het niveau van individuele afgestudeerden kunnen beperkingen op migratie, of gedwongen vertrek, gerelateerd zijn aan beperkte opties op de lokale arbeidsmarkt, waar de beste studenten in veel gevallen als eerste geworven worden. Daarnaast kunnen ook factoren buiten de arbeidsmarkt, zoals de huishoudensituatie of omgevingskwaliteiten een rol spelen. Verschillende groepen afgestudeerden worden hierdoor op verschillende wijze beïnvloed. Zo zal woonkwaliteit op potentiële migranten in verschillende levensfasen een verschillende uitwerking hebben. Naast de beschikbaarheid van banen is kennis van de achtergrondkenmerken van recent afgestudeerden dus van belang. Daarbij moet, gegeven de resultaten in hoofdstuk 5, wel in ogenschouw genomen worden dat factoren die de woonkwaliteit positief beïnvloeden ook positieve effecten kunnen hebben op de arbeidsmarkt, en vice versa.

Op basis van hoofdstuk 4 kan geconcludeerd worden dat ruimtelijke mobiliteit in het verleden de kans vergroot op ruimtelijke mobiliteit in de toekomst. Omgekeerd geldt ook dat afgestudeerden die afkomstig zijn uit de regio's waarin ze hun graad behaald hebben, een grotere kans hebben daar ook te blijven werken. Het vergroten van de kennis over de (economische) mogelijkheden in de regio, nog voordat studenten beginnen aan het hoger onderwijs, kan helpen bij het vasthouden of werven van deze studenten, omdat dit bouwt op al bestaande patronen van herhaalde en

retourmigratie. Kennis van de regionale mogelijkheden vergroot de kans op retourmigratie van studenten die elders gaan studeren en voor wie herhaalde ruimtelijke mobiliteit een minder grote stap is. Tegelijkertijd neemt de kans toe dat studenten die kiezen voor een lokale opleiding, na afronding daarvan blijven.

7.4 Discussie en suggesties voor toekomstig onderzoek

In deze paragraaf bespreek ik een methodologisch aspect en dataset die zijn toegepast in dit proefschrift. In de hoofdstukken 2 tot en met 5 is een grote variëteit aan kwantitatieve methoden toegepast. De benaderingen in hoofdstukken 2, 3 en 4 hebben met elkaar gemeen dat er zowel variabelen op individueel niveau, als variabelen op regionaal niveau worden meegenomen in de modellen. In hoofdstukken 2 en 4 gaat hier hierbij vooral om een controle voor regionale omstandigheden. In hoofdstuk 3 ga ik een stap verder en probeer ik een relatie te leggen tussen individuele migratiekeuzes en regionale omstandigheden. In een dergelijk onderzoekontwerp is het van groot belang rekening te houden met het feit dat de modeluitkomsten mede bepaald kunnen worden door correlaties tussen die individuen, wanneer zij bijvoorbeeld uit hetzelfde gebied afkomstig zijn. In de literatuur wordt dit wel clustering genoemd; zie Snijders en Bosker (2004) voor een bespreking van dit probleem vanuit sample theorie. Vaak wordt hiervoor gecorrigeerd door cluster-robuste standaardfouten toe te passen. Deze methode helpt voorkomen dat de hypothese dat er geen effect is van het hogere niveau, dat wil zeggen, de groep waartoe het individu behoort, onterecht verworpen wordt. De kans op een onterecht significant resultaat wordt namelijk vergroot, wanneer er positieve correlaties tussen individuen uit dezelfde groep bestaan, die nog niet accuraat zijn meegenomen in het model. Hieronder bespreken we deze mogelijkheid voor het voorbeeld van hoofdstuk 3.

Vaststellen op welke niveaus deze correlaties zich voordoen is geen eenvoudige zaak. In het geval van hoofdstuk 3 is het goed voorstelbaar dat clusteren op het niveau van provincies noodzakelijk is. Immers, de regionale variabelen in het model zijn op dit niveau gemeten. Daarnaast is het te verwachten dat, indien er correlaties bestaan tussen het migratiegedrag van afgestudeerden, deze correlaties zich voordoen tussen studenten uit dezelfde afstudeerregio. Verder zouden er zich ook correlaties kunnen voordoen tussen studenten die in hetzelfde jaar de hogeschool of de universiteit verlaten hebben. Zij worden immers blootgesteld aan dezelfde (macro-) economische omstandigheden. Ik heb in het model diverse regionale en macro-economische variabelen opgenomen, die voor deze effecten zouden moeten controleren. In de literatuur wordt daarnaast ook veel gewerkt met “fixed effects”. Beide methoden sluiten echter niet uit dat er zich nog correlaties voordoen.

Cameron *et al.* (2006) stellen een methode voor die ingezet kan worden wanneer er, zoals in hoofdstuk 3, sprake lijkt te zijn van niet-geneste, tweedimensionale clustering. Deze methode komt neer op het eerst apart schatten van de correlaties op de beide dimensies, waarna gecorrigeerd wordt voor de gedeelde variantie tussen de beide dimensies. De auteurs merken echter wel op dat er op beide dimensies sprake moet zijn van voldoende groepen binnen elk cluster. Een vaak toegepaste vuistregel is dat er minimaal vijftig groepen in een cluster moeten zijn (Kézdi, 2004). In het geval van hoofdstuk 3 schat ik het model voor de hbo-afgestudeerden op basis van twaalf provincies en twaalf tijdsperioden (zie Tabel 3.5). Het model voor de universitair afgestudeerden is geschat op basis van acht provincies en tien tijdsperioden (zie Tabel 3.6). Dit bemoeilijkt het toepassen van de methode van Cameron *et al.* (2006). Een alternatief zou kunnen zijn clusteren op basis van een gecombineerde provincie x tijd groepsindeling. Een dergelijke indeling is theoretisch minder aantrekkelijk, want men corrigeert dan slechts voor de correlaties tussen afgestudeerden die in hetzelfde jaar, in dezelfde provincie zijn afgestudeerd. De correlaties tussen afgestudeerden uit dezelfde provincie, maar in verschillende jaren, wordt dan niet meegenomen bijvoorbeeld. Ik heb deze eendimensionale correctie toegepast op de resultaten in Tabellen 3.5 en 3.6 in hoofdstuk 3. De resultaten, die op aanvraag verkrijgbaar zijn, laten dezelfde coëfficiënten en marginale effecten zien, als gerapporteerd in het hoofdstuk, zoals verwacht, want de methode corrigeert immers de standaardfouten. De significantie van enkele effecten is wel verminderd, dit betreft vooral de effecten waarvoor ik in hoofdstuk 3 al bescheiden marginale effecten heb gerapporteerd. De hoofdconclusie, dat de ruimtelijke mobiliteit van afgestudeerden, naast enkele secundaire effecten, vooral wordt bepaald door de aanwezigheid van de een ruime arbeidsmarkt blijft van kracht.

Ik kom toe aan het tweede deel van deze discussie, aangaande de toegepaste dataset. De analyse in dit proefschrift is gebaseerd op de jaarlijkse hbo- en wo monitor van het Research Centrum voor Onderwijs en Arbeidsmarkt, Universiteit Maastricht. Uit deze survey heb ik de hbo- en wo afgestudeerden geselecteerd die ten tijde van het onderzoek niet ouder dan 30 jaar waren en een voltijd opleiding hebben genoten. Afgestudeerden worden ongeveer anderhalf jaar na het afstuderen geënquêteerd op onderwerpen als de kenmerken van de opleiding en de baan die men op dit moment heeft. In dit proefschrift is de data uit de waves 1997 tot 2008 geanalyseerd, waarbij in sommige hoofdstukken een sub-set van de data is gebruikt, in verband met variabelen die alleen in bepaalde jaren uitgevraagd zijn. De dataset geeft een gedetailleerd en representatief beeld van de eerste stappen op de arbeids- en woningmarkt voor deze elf opeenvolgende afstudeercohorten.

De dataset kent uiteraard zijn beperkingen en daarnaast zijn er enkele mogelijk relevante en interessante additionele onderwerpen buiten het beslag van dit proefschrift gebleven. Hierna bespreek ik deze zaken en de mate waarin ze zouden kunnen leiden tot een toekomstige onderzoekagenda.

Ten eerste heb ik de arbeidsmarktsituatie en ruimtelijke mobiliteit ongeveer anderhalf jaar na het afstuderen bestudeerd. De resultaten geven aan dat deze periode op zichzelf genoeg is om een goed beeld te geven van de eerste stappen op de arbeidsmarkt. De transitie van hoger onderwijs naar werk is in de meeste gevallen afgerond. Er is echter reden om te veronderstellen dat het beeld verandert wanneer we het observatie raamwerk verlengen naar bijvoorbeeld vijf of tien jaar na het afstuderen. Afgestudeerden zullen carrièrestappen gaan maken en ook in de persoonlijke levenssfeer kunnen veranderingen optreden die andere (ruimtelijke) keuzes met zich meebrengen. Deze dynamiek kan ook een verzwakking van de relatie tussen afstudeerrichting en ruimtelijke mobiliteit met zich meebrengen. Toekomstig onderzoek zou zich daarom kunnen richten op een periode die verder van het afstuderen af ligt. Voor steden zou een dergelijke studie inzicht kunnen verschaffen in de mate waarin de stedelijke arbeidsmarkt niet alleen aantrekkelijk is voor recent afgestudeerden, maar ook verdere carrièrestappen voor deze groep kan faciliteren. Daarnaast kunnen huishoudenformatie processen een belangrijker rol gaan spelen, wat gevolgen kan hebben voor de belangrijkste determinanten van locatiekeuze. In het huidige onderzoek was het niet mogelijk de huishoudendimensie mee te nemen. Dit is een belangrijke component in onderzoek dat zich richt op de langere termijn na het afstuderen.

Ten tweede heb ik mij in dit proefschrift geconcentreerd op de arbeidsmarkttuitkomsten voor recent afgestudeerden in het algemeen. Daarbij is niet specifiek aandacht besteed aan studentondernemerschap. Er is veel beleidsaandacht voor het stimuleren van studentondernemerschap, bijvoorbeeld door de facilitaire ondersteuning van kleine bedrijven die gelieerd zijn aan de lokale kennisinstellingen. Inzicht in de ruimtelijke mobiliteit van deze ondernemers is er op dit moment onvoldoende, maar kan belangrijke informatie opleveren over de lokale effectiviteit van dergelijk stimulerend beleid. Gezien de mogelijke banden met lokale afnemers en toeleveranciers ligt het in de lijn der verwachtingen dat succesvolle studentondernemers een lagere ruimtelijke mobiliteit vertonen.

Ten derde heb ik studenten die gedurende hun studie uitvallen niet kunnen meenemen. Deze groep zou hoogst selectief kunnen zijn, zowel in positief als negatief opzicht. Enerzijds zou het zo kunnen zijn dat deze groep een bezigheid heeft gevonden die lucratiever geacht wordt dan het voltooien van een hogere opleiding. Anderzijds zou verondersteld kunnen worden dat deze groep nadelige effecten ondervindt van het

niet halen van een hoger diploma bij het zoeken naar werk. Een nadere studie naar deze groep zou beleidsmakers kunnen voorzien van nuttige informatie met het oog op programma's die gericht zijn op de transitie van onderwijs naar arbeidsmarkt.

Tenslotte stond de dataset slechts een beperkte analyse van de stromen van studenten en afgestudeerden van en naar het buitenland toe, afgezien van de controle variabelen met betrekking tot nationaliteit en het vertrek van afgestudeerden van Nederlandse instellingen voor hoger onderwijs naar een baan in het buitenland. Daarmee zou een vierde mogelijk onderzoek een vergelijkende studie naar de soortgelijke patronen binnen Europa zijn. Ook zouden belangrijke inzichten ontleend kunnen worden aan een studie naar de stromen van afgestudeerden van en naar de zogenoemde BRIC (Brazilië, Rusland, India en China) landen. Dit proefschrift behandelde vooral de stromen tussen Nederlandse regio's. Het intensiveren van de relaties met regio's binnen en buiten Europa, door de ruimtelijke mobiliteit van studenten en afgestudeerden, zou een essentiële voorwaarde voor aanhoudende economische groei kunnen betekenen.

Referenties

- Becker, G. (1964) *Human capital*. New York: Columbia University Press.
- Berry, C. R. and Glaeser, E. L. (2005) The divergence of human capital levels across cities. *Papers in Regional Science*, 83(3), 407-444.
- Cameron, A.C., J.B. Gelbach and D.L. Miller (2006) *Robust inference with multi way clustering*. NBER Technical Working Paper 327, National Bureau of Economic Research, Cambridge, MA, USA.
- Détang-Dessendre, C., Drapier, C. and Jayet, H. (2004) The impact of migration on wages: empirical evidence from French youth. *Journal of Regional Science*, 44(4), 661-691.
- Duranton, G. and Puga, D. (2004) Microfoundations of urban agglomeration economies. In J. V. Henderson and J. F. Thisse (Eds.), *Handbook of urban and regional economics*, Elsevier B.V.
- Faggian, A. and McCann, P. (2009) Human capital and regional development. In R. Capello and P. Nijkamp (Eds.), *Handbook of regional growth and development theories* (pp. 133-151). Cheltenham, UK: Edward Elgar.
- Fielding, A. J. (1992) Migration and social mobility: south-east England as an escalator region. *Regional Studies*, 26(1), 1-15.
- Gottlieb, P. D. and Joseph, G. (2006) College to work migration of technology graduates and holders of doctorates within the United States. *Journal of Regional Science*, 46(4), 627-659.
- Graves, P. E. and Linneman, P. (1979) Household migration: Theoretical and empirical results. *Journal of Urban Economics*, 6(3), 383-404.
- Kézdi, G. (2004) *Robust standard error estimation in fixed-effects panel models*. Hungarian Statistical Review Special (9), 96-116.
- Lehmer, F. and Ludsteck, J. (2011) The returns to job mobility and inter-regional migration: evidence from Germany. *Papers in Regional Science*, 90(3), 549-571.

- Lucas, R. E. (1988) On the mechanics of economic development. *Journal of Monetary Economics*, 22, 3-42.
- Moretti, E. (2004a) Estimating the social return to higher education: evidence from longitudinal and repeated cross-sectional data. *Journal of Econometrics*, 121, 175-212.
- Moretti, E. (2004b) Human capital externalities in cities. In J. V. Henderson and J. F. Thisse (Eds.), *Handbook of urban and regional economics* () Elsevier B.V.
- Moretti, E. (2004c) Workers' education, spillovers, and productivity: evidence from plant-level production functions. *The American Economic Review*, 94(3), 656-690.
- Nijkamp, P. and Poot, J. (1998) Spatial perspectives on new theories of economic growth. *Annals of Regional Science*, 32, 7-37.
- Partridge, M. (2010) The duelling models: NEG vs amenity migration in explaining US engines of growth. *Papers in Regional Science*, 89(3), 513-536.
- Plane, D. (1993) Demographic influences on migration. *Regional Studies*, 27(4), 375-383.
- Romer, P. M. (1986) Increasing returns and long-run growth. *The Journal of Political Economy*, 94(5), 1002-1037.
- Romer, P. M. (1990) Endogenous technological change. *The Journal of Political Economy*, 98(5, Part 2: The Problem of Development: A Conference of the Institute for the Study of Free Enterprise Systems), S71-S102.
- Sassen, S (2001) *The Global City: New York, London, Tokyo*. Princeton University Press, New Jersey.
- Snijders, T.A.B. and R.J. Bosker (2004) *Multilevel analysis; an introduction to basic and advanced multilevel modeling*. Sage Publications, London, U.K.
- Storper, M. and Scott, A. J. (2009) Rethinking human capital, creativity and urban growth. *Journal of Economic Geography*, 9, 147-167.
- Venhorst, V. A., Edzes, A. J. E., Broersma, L. and Van Dijk, J. (2011) *Brain drain of brain gain? Hoger opgeleiden in grote steden in Nederland*. Nicis Institute, The Hague, the Netherlands.
- Whisler, R. L., Waldorf, B. S., Mulligan, G. F. and Plane, D. (2008) Quality of life and the migration of the college-educated: a life-course approach. *Growth and Change*, 39(1), 58-94.

Stellingen behorend bij het proefschrift

Smart move? The spatial mobility of higher education graduates

door Viktor A. Venhorst

1. Recent graduates from Dutch universities are more spatially mobile than their college counterparts (this thesis).
2. A graduate's academic discipline is a better predictor of spatial mobility than his / her graduation grade (this thesis).
3. The availability of jobs is the key determinant of spatial mobility of recent graduates (this thesis).
4. The patterns of spatial mobility of recent graduates are mostly structural in nature (this thesis).
5. The quality of the job-match is related to spatial mobility, but is not explained by it (this thesis).
6. A relatively strong inflow of recent graduates on the city labour market leads to productivity spillovers, whereas a relatively strong inflow of graduates in city residential areas leads to consumption spillovers (this thesis).
7. In itself, "brain drain", or the phenomenon that after graduation, the majority of a given graduation cohort leaves their college or university city to work elsewhere, is not a problem (this thesis).
8. PhD candidates who work well under pressure benefit from having a demanding, time consuming and intensive hobby.
9. Workplace learning and cooperation are inversely proportional to the walking distance between the relevant colleagues.
10. In evaluating the societal relevance of research, it should be realized that scientists also belong to society.